

Disposables Handbook

Basic Knowledge of Legislation
and Raw Materials

Update: March 2021

supported by: **Sustainability**
SCHOOL



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Preface

Julia Del Pino Latorre

Head of Sustainability

Dear reader,

I am very pleased that this Disposables Handbook has found its way to you and I hope that it will help you to answer one or the other question.

The reasons for preparing this handboock were the enormous amounts of plastic waste in the world's oceans as well as the resulting EU Single-Use Plastics Directive that must be implemented into national law by July 2021.

We are selling a wide range of products for everyday use, including disposable tableware and food packaging for hotels, restaurants, caterers, canteens, fresh food counters and snack bars. Therefore, the announcement of legal

restrictions in this area, the non-transparent labyrinth of ecological certifications as well as uncertainties regarding some alternative disposable materials confronted us with challenging questions like:

- What will be allowed to sell in future?
- What material can be recommended responsibly?
- Which alternative materials should be avoided for the sake of the environment?
- What do the various eco-certifications mean?

As a family-run network, we have been striving for years to

meet our corporate responsibility towards the society and the environment. At the beginning of 2020, we have made a public commitment to support [the 10 principles of the UN Global Compact](#), the world's largest initiative for sustainable business. In this course, we have integrated the protection of human rights, fair labour conditions, environmental protection and anti-corruption into our everyday business. We prepare an annual report to communicate our progress to this regard in a transparent manner. Our commitment towards sustainability has already been awarded a CSR Gold Ranking by the independent platform EcoVadis.

Furthermore, our sustainability strategy is underpinned by the United Nations Sustainable Development Goals (SDGs). As an international distribution network, we can make a particular contribution to SDG 12 (Sustainable Consumption and Production). This is why we are working on minimizing the use of resources and on facilitating the recyclability of our products and their packaging as part of the continuous sustainable development of our portfolio.

Consequently, this handbook focuses on the origin, production and circularity of the conventional and new disposable materials. The lack of clarity regarding the actual biodegradability of bio-based materials have led us to the conduction of our own composting tests, together with the waste management company ALBA in Berlin, Germany. In addition to providing insights into these test results, we would like to give you, our customers and interested readers, useful and comprehensible answers to the aforementioned questions and show you where the disposable packaging journey could take us.

We are pleased to share these findings with you and hope that together we will step by step be able to truly act responsibly.

Yours



Chapter 1

**Legal Basics for
Handling Disposables**



1.1

EU Waste Framework Directive

With the aim of conserving resources and promoting the circular economy, the EU Waste Framework Directive defined the waste hierarchy.

1. Prevention

According to the hierarchy, the (amount) of packaging or products should first be reduced so that waste does not occur in the first place.

2. Preparing for Re-Use

If this is not possible, „preparation for re-use“ should be aimed for. This includes e.g. the cleaning of reusable containers. Only if this is not possible should disposable packaging be considered.

3. Recycling

The next stage, recycling, refers to material recycling. This means that from a recycled packaging, a new packaging can be made.

4. Energy Recovery

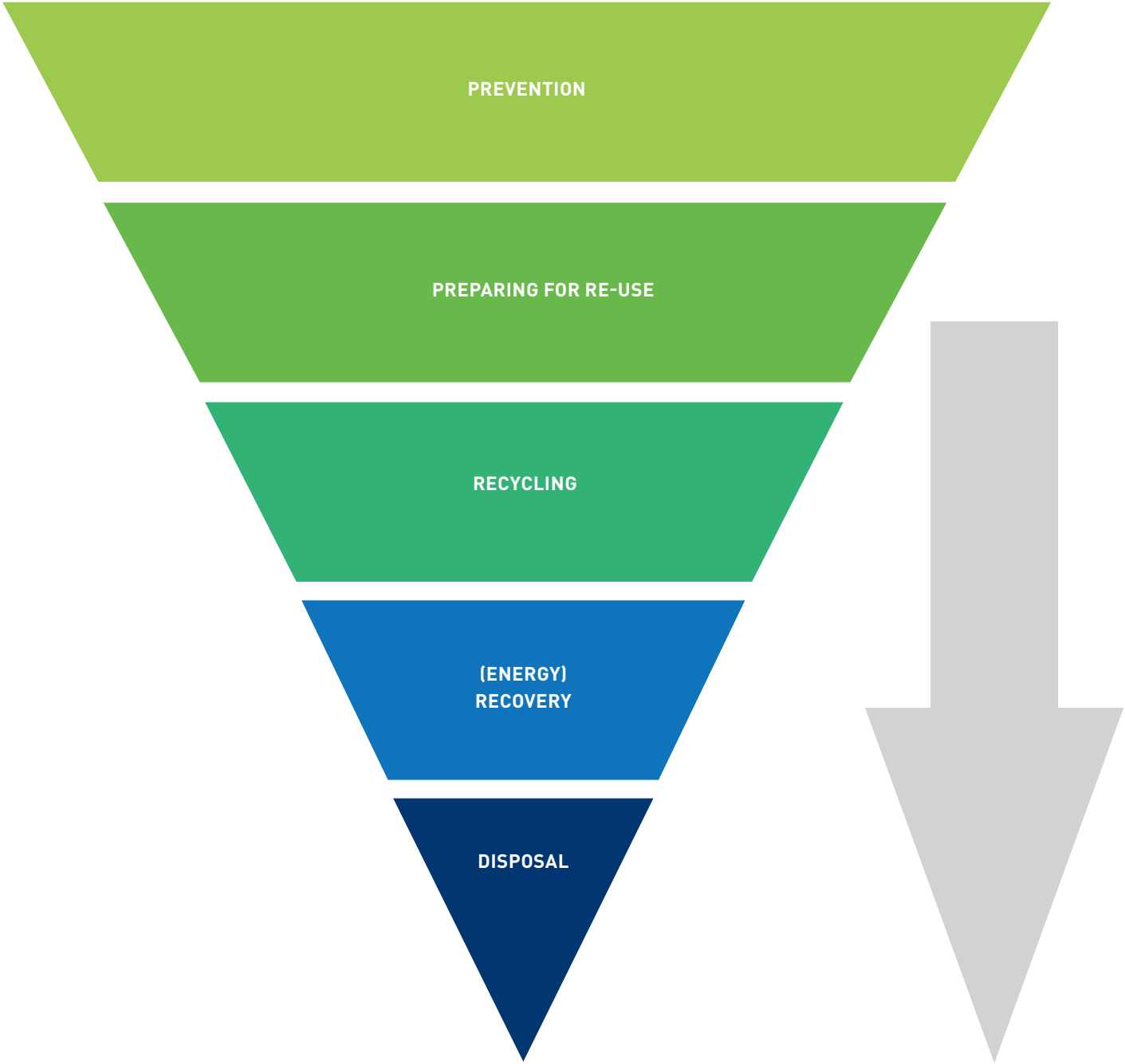
Only after this step should the energy recovery (combustion) be taken into consideration. Almost all disposable packaging can usually only be used for the generation of energy after use, since there are no effective cycles.

5. Disposal

As a last resort, disposal (e.g. in a landfill) should be considered. Direct landfilling of waste is prohibited in many countries. The garbage has to be pre-treated there. In most cases, this means that the waste is used for energy recovery.

The plastics strategy and the associated EU directive on single-use plastics, which are explained below, are also intended to contribute to the goal of creating cycles and conserving resources.

Similarly, the Sustainable Development Goal 12.5 of the 2030 Agenda states that waste generation should be significantly reduced by avoiding, reducing, recycling and reusing.





1.2

EU Single-Use-Plastics Directive

8 million tons of plastic end up in the oceans every year. This corresponds to five shopping bags per 30 centimeters of all coastlines, worldwide. Disposable plastic items constitute the largest waste group found on coasts and beaches.

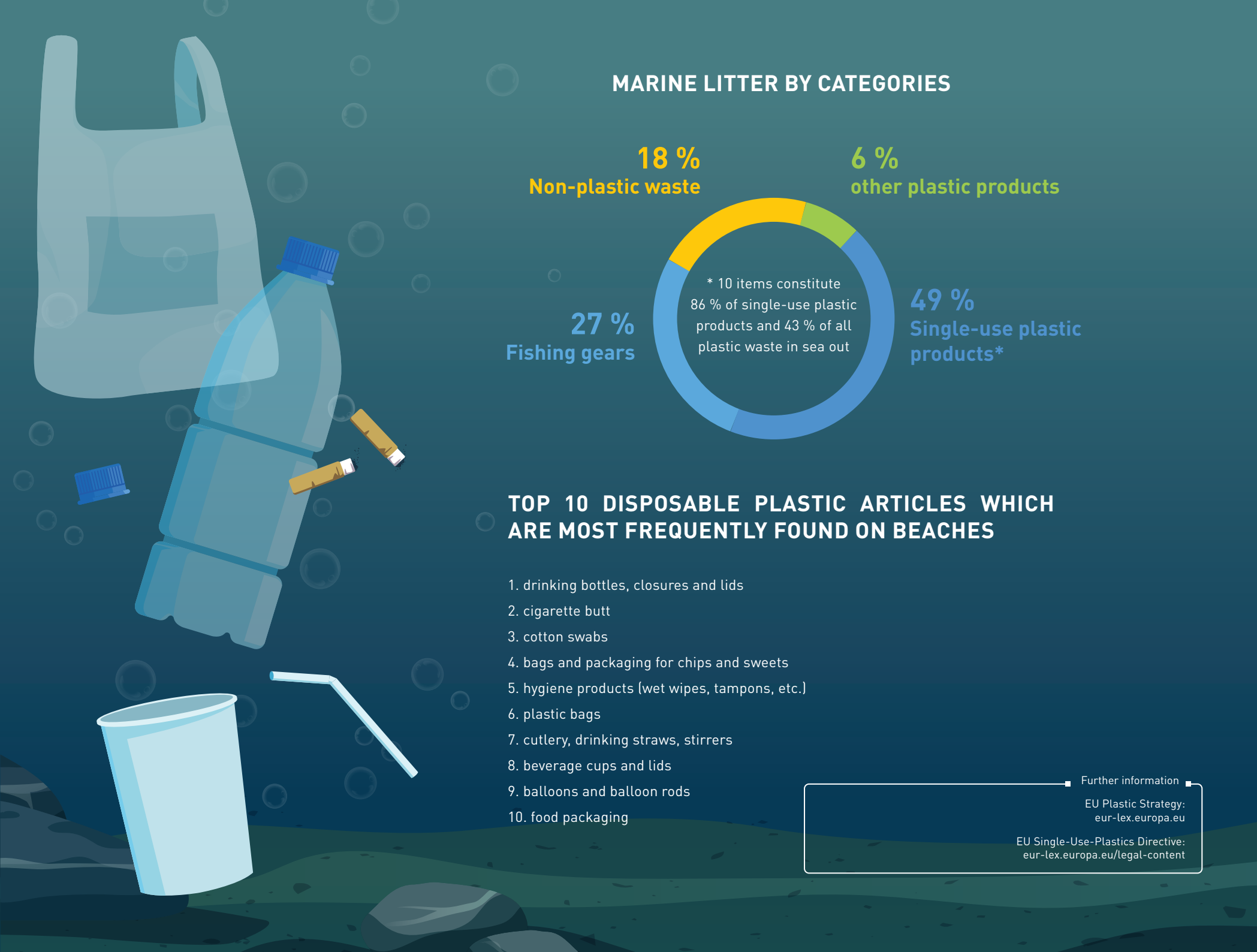
Reducing marine litter is important for achieving the United Nations Sustainable Development Goal 14. This goal is about the conservation and sustainable use of the oceans, seas and marine resources. 80 to 85 % of marine litter in the EU is plastic, with 50 % of it being single-use plastic items (e.g. plastic cutlery and beverage bottles).

The plastics strategy adopted by the EU is intended to protect the environment from plastic pollution, support the transition to a circular economy and promote growth and innovation. It is part of the EU circular economy action plan.

The following goals should be achieved:

- increase sorting and recycling capacities
- increase demand and use of recycled plastics
- reduce disposable plastic
- containment of microplastics
- from 2030, all plastic packaging should be reusable or recyclable

The plastics strategy calls on the industry to make commitments, particularly with regard to the use of recycled plastics.





The “Directive on the reduction of the impact of certain plastic products on the environment”, also colloquially called the EU Single-Use Plastics Directive, is part of the EU plastics strategy. It entered into force on July 2, 2019. The EU member states must implement the directive into national law by July 3, 2021.

The directive is intended to help reduce plastic waste, create closed loops and protect the environment and human health from exposure to plastics. The guideline promotes circular approaches that favor sustainable and non-toxic reusable items and reuse systems over single-use items.

The single-use plastic items affected by the directive account for approximately 86 % of all single-use plastics found on beaches in the EU during waste censuses. To counteract this development various guidelines will apply in the future for first-time placing on the market (manufacturers & importers). Which measures are to be taken for which single-use plastic item can be withdrawn from the table on the next page.

In addition to single-use plastic items, the directive also affects: cotton swabs, balloon sticks, beverage bottles and containers, tobacco products and filters.

The directive also applies to articles made from bioplastics

“Plastics made from modified natural polymers or biobased, fossil or synthetic starting substances do not occur in nature and should therefore be part of this directive. The adapted definition of the term “plastic” should therefore include polymerbased rubber items as well as biobased and biodegradable plastics, and that regardless whether they are obtained from biomass and/or should biodegrade over time.”

Item	Prohibition	Consumption reduction	Marking requirements	Extended producer responsibility	Awareness raising measures
	X	↓			
Plastic food containers*		↓			
Food containers (incl. cups) made of expanded polystyrene (EPS)	X				
Cups for beverages		↓			
Knives, forks, spoons, chopsticks, plates, beverage stirrers, drinking straws made of plastic	X				
Oxo-degradable plastics	X				
Packets and wrappers made from flexible material that are intended for immediate consumption					
Sanitary pads, tampons and tampon applicators					
Wet wipes, i.e. soaked wipes for body and household care (no industrial wipes)					



Guidelines

End of March 2021 some guidelines from the European Commission are expected to specify in greater detail which single-use plastic products are covered by the Directive. Amongst other things they should help to clarify whether the difference between a plate, food container and cup is dependent on shape, content or function.

* Definition of food container: “intended for immediate consumption, either on-the-spot or take-away, typically consumed directly from the receptacle and is ready to be consumed without further preparation [e.g. heating].”



X Restrictions on Placing on the Market

Restriction on placing on the market means that the relevant articles are prohibited. They must no longer be placed on the market.

Affected disposable packaging/ catering items are:

- *plastic plates **
- *paper plates with plastic coating * ***
- *plastic cutlery **
- *plastic beverage stirrers **
- *plastic straws **
- *food packaging made of expanded polystyrene (EPS)*
- *items made of oxo-degradable plastic*

- The EU directive must be transposed into national law by July 3, 2021.
- The national laws should include penalties if these products are still placed on the market.

* also bioplastics: Plastics are defined as "modified natural polymers manufactured from biobased, fossil or synthetic starting substances". This also means „biobased and biodegradable plastics, regardless of whether they are derived from biomass or are intended to biodegrade over time“

** The directive defines items as single-use plastic which are "wholly or partly made from plastic".



Consumption Reduction

Consumption reduction means that the consumption of these articles should be reduced, i.e. as few as possible should be placed on the market.

Affected disposables/catering items are:

- *plastic beverage cups with lids **
- *paper beverage cup with plastic coating * ***
- *food containers, i.e. boxes / bowls*

* also bioplastics: Plastics are defined as "modified natural polymers manufactured from bio-based, fossil or synthetic starting substances". This also means „bio-based and biodegradable plastics, regardless of whether they are derived from biomass or are intended to biodegrade over time“

** The directive defines items as single-use plastic which are "wholly or partly made from plastic".



- By 2026, there should be a measurable reduction compared to 2022.
- By July 3, 2021, member states should report on how the reduction should be measured and achieved.
- The directive does not specify how high the reduction should be.
- In 2027, the EU Commission will report on the quantitative reduction targets.



Labelling Requirements

Sanitary pads, tampons, tampon applicators and wet wipes must be labelled clearly on the packaging and beverage cups on the product itself with following information:

- details on applicable or avoidable disposal options
- note, that the product is made of or contains plastic
- information on the negative environmental impacts of littering
- information must be printed on resp. in the case of beverage cups alternatively be engraved or embossed

Legal regulations for labelling:

The following graphics need to be printed on the different products from 3rd July 2021 on (wet wipes, hygiene products, plastic coated cups, and plastic cups).



Transition period: until 3rd July 2022 (date of placing on the market) labelling can be done alternatively with a sticker.

Further information regarding labelling requirements

<https://eur-lex.europa.eu/legal-content/EN/TXT/>



Awareness Raising Measures

EU member states should take measures to inform consumers and to incentivise responsible consumer behaviour, in order to reduce litter.

About the following should be informed:

- availability of reusable alternatives and reuse systems
- impact of littering on the environment, especially the oceans
- impact on sewerage system if disposed of improperly

Affected disposable packaging/ catering items are:

- food containers
- packets and wrappers made from flexible material that are intended for immediate consumption
- beverage cups and lids

To date no further specification on the time frame and the form of execution.



Extended Producer Responsibility

Extended producer responsibility means that the producer of the product must cover all costs that:

- arise in connection with the waste, e.g. cleaning the environment, waste collection infrastructure etc.
- costs of awareness-raising measures

These costs can be passed on in the chain by the producer.

Affected disposable/catering items are:

- food containers
- beverage cups
- beverage containers (e.g. beverage bottles)
- packets and wrappers made from flexible material that is intended for immediate consumption
- bags and plastic packaging / wrappers

For beverage containers (e.g. beverage bottles) made of plastic and composite materials guidelines are valid at the latest from 5th January 2023.

Guidelines for the other articles are valid as of December 31, 2024, at the latest.



Chapter 2

Recycling and Composting



Recyclability and the Use of Recycled Materials

If a disposable food packaging is labelled with “recyclable”, it is usually only downcyclable. This means that the recycled material in question cannot be used to produce a comparable single use packaging, but only an inferior product.

The use of recycled materials in disposables is quite limited. Food packaging made from recycled paper has the risk of contaminating the food with mineral oils from printing inks. There is no EU wide law existing which is prohibiting the use of recycled paper (PCR) in food contact but it is recommended by various institutes e.g. the EFSA (European Food Safety Authority) and the German BfR (Bundesinstitut für Risikobewertung) to use recycled materials only if there is a barrier layer (e.g. fresh fibres) between the food and the recycled material. Those materials should then only be used for dry and non-fatty food.

It is also important to note that the word “recyclable” is often misused for advertising purposes. Most of the time, materials are only theoretically recyclable. An example of this is the bio-plastic PLA, which is theoretically recyclable, but in reality, there is no material flow to separate and recycle it for further usage.



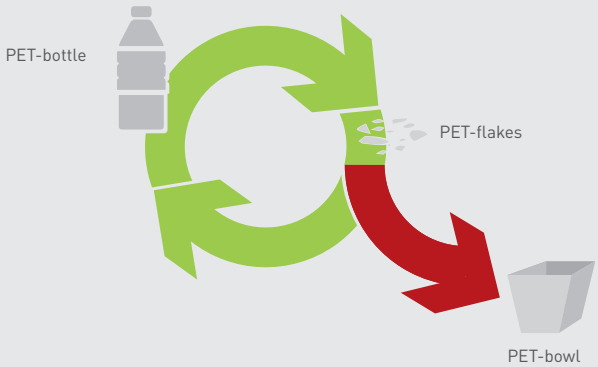
A product is recyclable if:



- there is an existing collection structure, i.e. the material is actually collected for recycling



- there is an existing recycling structure (on an industrial scale), i.e. in sorting plants the material components can actually be separated from one another and are collected in separate sections



- material recycling takes place, i.e. the recycled material obtained can replace “fresh” raw materials in the manufacture of new products





2.2

Compostability

In general, when it comes to compostability, it is important to differentiate between garden/home compostability and industrial compostability.

The composting process varies in the different countries and is executed in more or less controlled conditions (humidity, temperature, ventilation etc.), usually done over a period of 6 to 12 weeks. The problem here is that e.g. biodegradable plastics often do not spend the full 12 weeks in the composting plant, which they would theoretically need to decompose.



The temperatures in a garden compost are significantly lower and less constant than in an industrial plant. Therefore, composting is more difficult and takes longer.

It is also important whether a natural raw material (not chemically modified) or a synthetically produced bioplastic is to be composted. According to current knowledge, bioplastics have no valuable properties for the compost. Since bioplastics have neither material nor energetic benefits in the compost, they should be disposed of via the plastic recycling stream or, if not available, in the general waste. In addition, bioplastics are often not wanted by the composting plants because they interfere with the composting process and cannot be distinguished from conventional plastics.



The most used standard for certified compostability is the European standard EN 13432 on the compostability of packaging.

The industrial compostability of packaging in accordance with the standard EN 13432 is not tested in a real compost heap. Rather, the optimal composting conditions are simulated in a laboratory.

The standard states that 90 % of the material must have decomposed into components smaller than 2 mm in 12 weeks. In reality however, these optimal, theoretical conditions often do not exist. No compostability has to be proven for 5 % of the additives. In the worst case, these additives, which may not be compostable, reach the fields in agriculture via composting and contaminate the soil.



The most common certifications in Europe are listed below:

INDUSTRIAL COMPOSTABILITY

OK Compost Industrial

- confirms industrial compostability
- certified by TÜV AUSTRIA Belgium *
- is based on EN 13432
- test temperature: 40 - 70 °C

German DIN-tested industrial compostability

- confirms industrial compostability
- certified by DIN CERTCO
- is based on EN 13432

Seedling

- confirms industrial compostability
- from the European Bioplastics e.V.
- is based on DIN EN 13432

HOME COMPOSTABILITY

OK Compost Home**

- confirms home compostability
- certified by TÜV AUSTRIA Belgium *
- is based on TÜV Austria's own requirements
- test temperature: below 30 °C
- must be completely degraded in 12 months

German DIN-tested garden compostability

- confirms home compostability
- certified by DIN CERTCO
- is based on the Australian standard AS 5810 and the French standard NF T 51-800 for garden compostability
- test temperature: 20 - 30 °C
- must be completely degraded in 12 months

* Former Belgian test institute Vinçotte

** "OK Compost home" was the first certificate for home compost; the specifications formulated therein served as a template for various other standards on home compostability, e.g. for the Australian standard AS 5810 and the French standard NF T 51800 for home compostability.



EcoCreation Composting Machine

Not only are there many rules that apply to plastics and packaging, there are also a number of requirements for the treatment and recycling of food and kitchen waste.

Where there are at least 40 kg of organic waste per day, the composting system from EcoCreation can solve disposal problems.

With the system, organic waste can be immediately and sustainably converted into dry compost on site, and emissions can be reduced by reducing the quantities to be transported. The freezer-sized machine processes up to 270 kg of organic waste within 24 hours. The compost can be spread safely in any green area or sold to local biogas plants.



A rotor mixes the filled garbage, and the mass is heated to remove the moisture. The resulting water vapor is discharged through a filter system. Bacteria do the rest of the work and naturally break down proteins, fats and cellulose at high speeds.

As long as the proportion remains below 30 - 50 %, approved compostable packaging can also be placed in the composting plant.

The experts at INPACS will be happy to advise you on the right machine size, the appropriate bacterial mixture and the pay-back periods.

Your local INPACS contact takes care of the operational setup and regular maintenance of the machine.





Study for Testing the Compostability of Selected Disposable Materials

Biodegradable, compostable - the consumer connects closed cycles with these attributes. One imagines: These products are made into compost and as such are distributed over agricultural areas and thus into new plant products. But does this happen in reality?

Apart from the question of whether these products actually end up in composting plants, how do the materials in question behave in composting plants and can the promised cycle actually be closed?

To find out, Hildebrandt & Bartsch, our partner in Berlin, and the german certified waste disposal company ALBA tested the relevant alternative disposable materials under real conditions in a composting plant as part of a cooperation project - a task that would actually be expected from the manufacturers, but which is not common today due to the widespread certification methods under laboratory conditions (see Chapter 2.2).



Hildebrandt & Bartsch provided a large container with 20 m³ of sample material for the test procedure.

For testing in the composting plant, ALBA mixed the test material with 20 m³ of conventional bio-waste (green waste, contents of bio-waste bins) and set up two compost heaps. The aim was to check whether the material decomposes within the economically required 12 weeks and whether it benefits the composting plant operator.

The testing led to very different results for the diverse materials: the coated paper cups, for example, did not decompose in time, the wooden cutlery did.

The quality of the compost is decisive

In addition to the compostability of the materials, however, the quality of the compost is the main factor determining whether biodegradable disposable packaging would be accepted by composting plant operators at all:

The demands on the quality and legal conformity of the compost as an end product are high, on the contrary, the contribution of the mentioned disposable materials to the quality of the compost is questionable.

About 14 times a year the quality of the compost is checked in the test plant, two negative samples in a row would lead to the withdrawal of its quality seal.

As a result, the plant would limit the acceptance quantity for the above-mentioned packaging materials to just 1 % of the reception capacity in order not to impair the quality of the compost.

Biodegradable does not necessarily mean biowaste

In addition, in Germany biodegradable plastic packaging would have to be declared as bio-waste in order to be disposed of in the organic-bin and later composted. Currently, however, they are declared as packaging according to the packaging law, which authorises their disposal via the yellow bag for plastics and packaging. However, since the disposable materials mentioned are not recyclable, they end up being incinerated in most cases (see chapters 2.1).

In summary, it can be stated that the biodegradability or compostability of such labelled disposable products does not become reality.

The advantage over plastic is lost unless the packaging ends up in landfill, which is still a common way of disposal in many

countries. Also, if littered in nature it can possibly be more environmentally friendly than plastic.

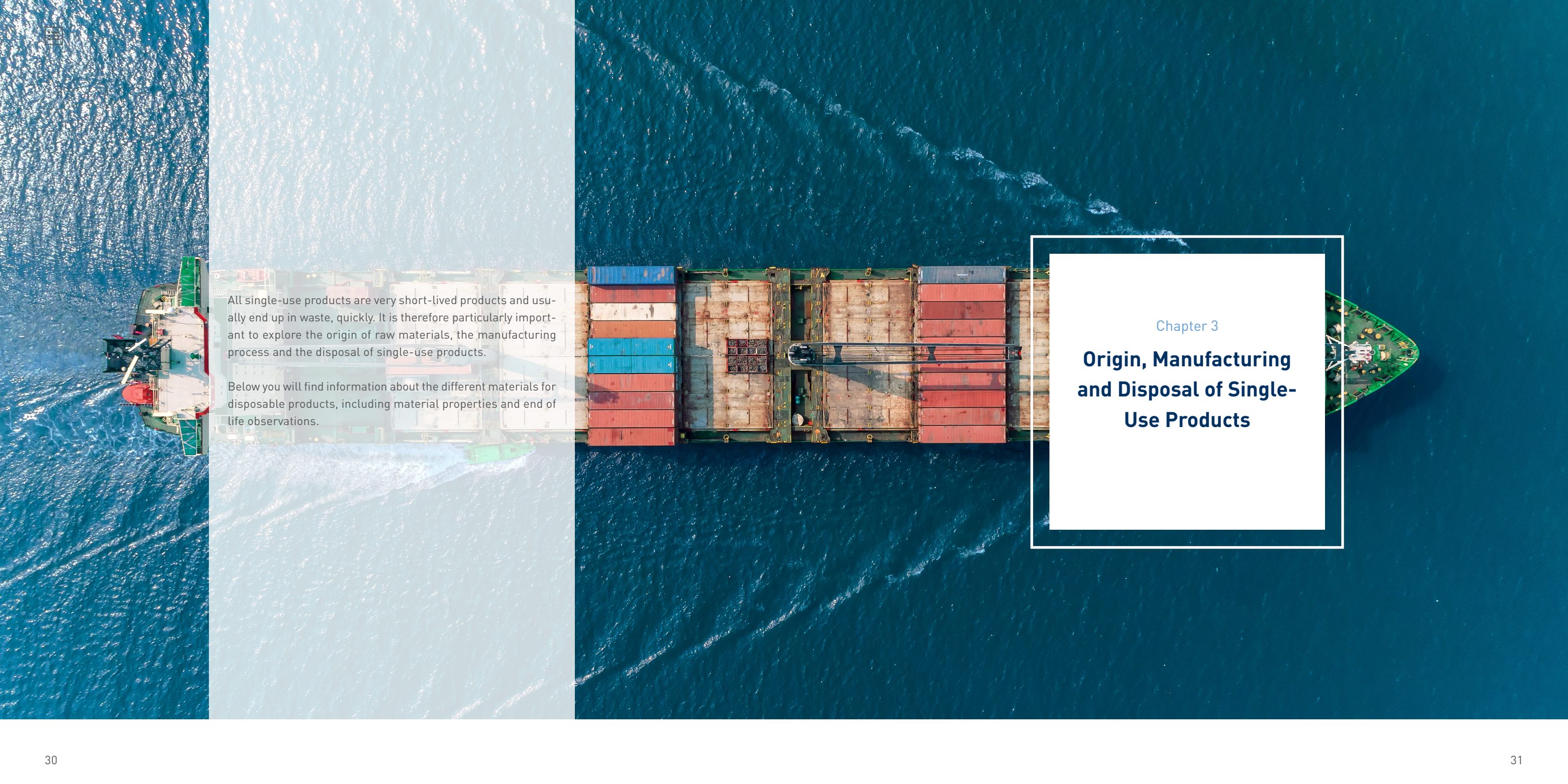
The hope that at least some materials could be disposed of in the organic or food waste bin in the future to create a cycle has vanished. According to what has been learned, this case would only come into play in individual cases after the explicit approval of the local disposal company, unless one has one's own composting machine (see Chapter 2.3).

At the same time, it is clear that no disposable material, whether of plastic or renewable raw materials, can be generally recommended as "the most ecological". The local conditions, especially with regard to disposal, play an important role for the ecologically most sensible choice of material. Please study the advantages and disadvantages of the various disposable materials on the following pages.

If the local conditions allow it, a reusable solution should be considered from an ecological point of view. Reusables not only reduce waste, but above all save resources and emissions.

A cooperation project from





All single-use products are very short-lived products and usually end up in waste, quickly. It is therefore particularly important to explore the origin of raw materials, the manufacturing process and the disposal of single-use products.

Below you will find information about the different materials for disposable products, including material properties and end of life observations.

Chapter 3

Origin, Manufacturing and Disposal of Single- Use Products

Wood

Wood is a renewable resource. Many disposable products can be made from wood, such as stirrers, cutlery, baking trays and serving boats, to name a few. Wood should preferably come from a certified source. Details on the most common labels and certificates can be found from page 57. Depending on the application and the required properties, the various products are made from pine, lime, poplar or birch wood.

After the tree has been cut down and debarked, thin layers of wood are cut off from the log with a knife. Then, for example, cutlery can be punched out of these “sheets” with heat.

These products are manufactured, for instance, in China, and are then shipped to Europe. After being used by the consumer, a wooden disposable packaging should be disposed of as residual waste and thus be used for energy recovery (incineration). Wood cannot be recycled through the paper waste stream.

As a natural renewable raw material, wood is theoretically also compostable, unless it is not contaminated with plastics or glue. However, whether or not a single-use wood product is actually composted and is not seen as a contaminant in the system depends on the conditions and time spent in the respective composting facility.



	Advantages	Disadvantages
Origin and manufacturing	- renewable raw material (not chemically modified) - grows anywhere (short distances) - no need of fertilizers or pesticides	- promotes forest monocultures and thus endangers biodiversity - high material input/weight (e.g. compared to paper and cardboard)
Disposal	combustible without pollutants	- releases CO₂ during incineration - not recyclable
properties	- looks high quality - fat-resistant - moisture-resistant - no health risks - suitable for freezing - suitable for microwaves - suitable for the oven	





Wood Pulp

Wood pulp, also known on the market as Chinet (brand name), is mainly used for plates and bowls or as a tray for coffee mugs.

The fibre pulp is created from wood mechanically shredded with grindstones and the addition of water. Unlike cellulose, it still contains lignin ("the natural glue between the wood fibers"). The lignin that is still present can cause the material to yellow over time (despite bleaching).

The Chinet products use post-industrial recycled wood fibers (for instance manufacturing scraps) instead of fresh wood pulp. To produce the products, the pulp is first pressed into shape and then dried.

After usage, the products can be disposed of via paper recycling if they are not greasy or very dirty. From this recycled material, new toilet paper, shipping boxes, carrying trays for coffee mugs or other products can be produced (not for applications with direct food contact).

Composting of paper and Chinet should not be carried out because the raw material is too valuable for this. Recycling should be seen as a superior recovery than composting.



	Advantages	Disadvantages
Origin and manufacturing	- renewable raw material (not chemically modified) - grows anywhere, short transport routes - no fertilizers or pesticides needed - can be made from post-industrial recyclate (scrap) - water during production is circulated	- may promote forest monocultures and thus endanger biodiversity - high water and energy consumption during production
Disposal	- if uncoated and not dirty, good recyclability - combustible without pollutants	- not recyclable as soon as contaminated with grease - releases CO₂ during incineration
Properties	- fat-resistant - moisture-resistant - no health risks - suitable for microwaves - customizable with print	



Paper and cardboard

Paper or cardboard is made from the renewable raw material wood or from recycled paper. Wood grows in many regions of the world, so the raw material for the products can either come directly from Europe or from distant countries.

After the tree has been cut down, the logs are debarked and mechanically grinded in the paper mill. These fibers (1 %) are then mixed with water (99 %) and then “cooked” with chemicals to produce the cellulose pulp. This also removes the lignin, which is responsible for making the paper yellow over time.



Long webs of paper are then produced in the paper machine from this pulp and additives might be added to improve the properties. Recycled paper could also be added to the pulp for products that are not intended for food contact. Depending on the intended use, the surface can still be treated in the process, e.g. to make the paper smoother, writable or water-repellent. In order to produce cardboard boxes, various paper webs are brought together and pressed together using pressure, without any adhesive.

Large amounts of water are required for the paper manufacturing process. However, this water is circulated in the machine and purified before it is released back into nature. From the finished paper/cardboard for instance, cups or paper bags can be made.

After usage, paper products should be disposed of via paper recycling. Paper should only be put on the compost in very small quantities and, if so, only unprinted. Disposal in the paper stream should always be preferred, since this represents a higher-quality recycling. Each time paper is recycled, the fiber length shortens. After about seven cycles, the paper fiber can no longer be recycled because it becomes too short. It can then be used for energy recovery through inceneration.

	Advantages	Disadvantages
Origin and manufacturing	- renewable raw material (not chemically modified) - grows anywhere (short transport distances) - no fertilizers or pesticides needed - water during production is circulated	- may promote forest monocultures and thus endanger biodiversity - possible use of chemicals (e.g. bleach) - high water and energy consumption during production
Disposal	- uncoated and not dirty, good recyclability - promotes a circular economy	- contaminated with grease not recyclable - releases CO₂ during incineration - coatings are a contaminant in recycling process
Properties	- fat-resistant - no health risk - suitable for microwaves - customizable with print	moisture-resistant only with coating





Tissue papers are used in almost all areas of daily life which is why we now take a closer look at this product group.

Examples of tissue papers are napkins, toilet paper and kitchen rolls. For the different areas of application, the paper needs to meet different properties. Kitchen roll paper, for example, should be able to absorb as much water as possible without tearing. Toilet paper, on the other hand, should dissolve as easily as possible in the canalization so that it does not clog the pipes. To improve the tear strength in kitchen rolls and napkins, a wet strength agent is added to the paper.

The long paper webs produced from the paper machine are brought together depending on the number of layers desired, connected by embossing, and perforated before being rolled onto the cardboard tube and cut.



For products that have no food contact, such as toilet paper, a recycled content of up to 100 % is possible. As a basic principle to conserve resources and the environment and to save energy as much as possible, unbleached paper made from recycled material should be used.

From an ecological point of view, recycled paper with a high degree of whiteness is to be viewed critically, because bleaching requires more energy and the use of chemicals and it involves a greater loss of fibers. In addition, only high-quality white recycled paper types can be used for the production of such bright white recycling tissue papers which in turn are only available in small quantities.

In the past, chlorine was often used for bleaching, which is very harmful to the environment. Today, bleaching is mainly carried out using low-pollutant processes. A distinction is made between ECF (bleached without elemental chlorine) or TCF (bleached without total chlorine). The ECF process uses bleach that still contains chlorine-containing ingredients. The TCF process uses oxygen or hydrogen peroxide for bleaching, which is gentler, but is only used in 5 % of the cases.

Both processes require a lot of water and energy, which is why it is best to use unbleached recycled paper. It is recommended to use a product with a label that also considers the energy and water consumption and the use of chemicals, such as the Blue Angel or the Nordic Swan.

Used and dirty napkins/kitchen roll paper should be disposed of with the residual waste. If they end up in paper recycling, greasy components can interfere with the recycling process, even the added wet strength agents can make recycling more difficult and parts of the fibers cannot be reused.

Advantages

Disadvantages

Origin and manufacturing

- renewable raw material (not chemically modified)
- grows also in Europe
- no fertilizers or pesticides needed
- water during production is circulated

- may promote forest monocultures and thus endanger biodiversity
- possible use of chemicals (e.g. bleach)
- high water and energy consumption during production

Disposal

- combustible without pollutants
- recyclable if not dirty
- recycled material: less use of energy
- recycled material: shorter transport routes
- recycled material: only a small percentage of new raw material has to be added

- releases CO₂ during incineration
- wet strength agent in e.g. kitchen roll complicates or prevents recycling
- contaminated with grease not recyclable
- recycled: lower whiteness degree





3.4

Bamboo

Bamboo can be used for skewers, stirring sticks, cutlery and more.

Bamboo grows mainly in Asia, and the main importing country is China. It is a quickly renewable raw material and has a very high CO₂ absorption capacity.

Bamboo often comes from small farmer plantations in China, from where it is then taken to be processed in local factories.

The bamboo cane is cut lengthwise into thin strips with sharp knives, which are then grounded into thin skewers. After that, they are ready to be shipped to Europe.

After usage, bamboo cannot be recycled. It should be disposed of with the residual waste and thus must be incinerated (energy recovery). Just as with wood, disposal in large quantities via the compost is to be regarded as critical.

	Advantages	Disadvantages
Origin and manufacturing	▪ rapidly renewable raw material, not chemically modified ▪ no fertilizers or pesticides needed ▪ high CO₂ absorption capacity ▪ promotes small farmers	▪ does not grow in Europe, long transport routes
Disposal	▪ combustible without pollutants	▪ not recyclable ▪ releases CO₂ during incineration
Properties	▪ fat-resistant ▪ water-resistant ▪ acid-resistant ▪ no health risk ▪ suitable for freezing ▪ suitable for microwaves ▪ more stable than wood	



Attention!

Reusable hot beverage cups made of bamboo are not 100 % bamboo. They always contain a certain amount of melamine and formaldehyde to hold the ground bamboo fibers together. Acids or heat can release toxic substances.



11.6

Palm Leaf

Palm leaf trays are made from the leaves of the betel nut palm (Areca palm tree) that naturally fall to the ground. Each product is unique with an individual grain.

The betel nut palm trees grow mainly in India. The fallen dry palm leaves are picked up by hand from the ground, brought to the factory and cleaned there with a high-pressure water jet. They are then shaped and punched out in a press under the influence of heat. After punching, the edges are cut straight and then the trays are dried. Finally, they are shipped to Europe.

After usage, the trays should be disposed of as residual waste. Composting is theoretically possible in small quantities, but could cause many problems in practice.

	Advantages	Disadvantages
Origin and manufacturing	▪ renewable raw material (not chemically modified) ▪ waste product ▪ promotes small farmers in India ▪ no fertilizers or pesticides needed	▪ does not grow in Europe, long transport routes ▪ limited availability ▪ depending on weather conditions, harvesting is only possible during the dry season ▪ comparatively high weight
Disposal	▪ combustible without pollutants	▪ releases CO₂ during incineration ▪ not recyclable
Properties	▪ fat-resistant ▪ moisture-resistant ▪ acid-resistant ▪ no risk to health ▪ suitable for freezing ▪ suitable for microwaves ▪ suitable for the oven ▪ lockable with lid ▪ very stable and resistant	



Bagasse

The material bagasse can be used, for example, in making bowls, plates and cups.

Bagasse is the term used for the fibrous remains when sugar cane is pressed out during sugar production. This is a waste product. Bagasse is partly criticized as a raw material for packaging because it is also needed as a fuel in the sugar factory and, at worst, is missing for this energy production.

Sugar cane only grows in tropical and subtropical areas, e.g. in Asia and South America. Sugar cane is a fast-growing plant that is ready to harvest after 12 months. Pesticides and fertilizers are often used in the industrial cultivation of sugar cane.

After pressing, the bagasse is dried and ground and then mixed with water and a natural binder (starch) to form the pulp. This resulting pulp is then formed with a mold to a plate or tray. In order to achieve a high liquid barrier, a coating can then be applied to the bagasse packaging.

After usage, the bagasse packaging should be disposed of with the residual waste, so recycling is not possible. Composting is theoretically possible in small quantities, but could cause many problems in practice.



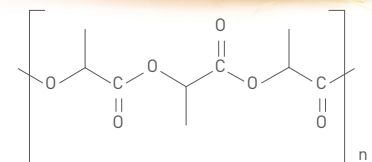
	Advantages	Disadvantages
Origin and manufacturing	▪ rapidly renewable raw material, not chemically modified ▪ waste product	▪ pesticides and fertilizers in sugar cane cultivation are used ▪ does not grow in Europe, long transport routes ▪ depending on the sugar industry ▪ in competition as a fuel in the sugar cane industry ▪ cultivation in monocultures
Disposal	▪ combustible without pollutants	▪ releases CO₂ during incineration ▪ not recyclable
Properties	▪ fat-resistant ▪ moisture-resistant ▪ acid-resistant ▪ no health risks ▪ suitable for freezing ▪ suitable for microwaves ▪ suitable for the oven ▪ lockable with a lid ▪ printable/customizable	▪ not infinitely moisture-resistant



Bioplastics

Bioplastics are plastics that are bio-based and/or biodegradable. Products that are declared as bio-based can either completely or just partly be made from renewable raw materials (biomass). Biodegradable products, on the other hand, can be transformed by microorganisms into CO₂, water and biomass.

In the following, two examples will be shown in more detail: PLA for biobased and biodegradable and Bio PE for biobased, but not biodegradable but recyclable.



Poly(lactid) Acid

PLA (Polylactic Acid) is a bioplastic made from lactic acid. This requires sugar or starch, which mostly comes from sugar cane or corn from South or North America. This sugar is fermented to lactic acid and then polymerized to PLA. In order to improve the properties of PLA, additives are often added, which could include some fossil based components.

The resulting granulate can then be used in the usual plastic processing, e.g. be further processed into a cup by injection molding. Such cups can be manufactured, for example in the EU, but also in Asia. If PLA products are used, it is important to note the limited durability and storage conditions (dry and below 40 °C).

After use, PLA products should be disposed of via plastic recycling resp. residual waste. In this way, after the sorting system, they are incinerated and can then be used for energy. There is currently no separate material stream for PLA, so it is not recyclable.

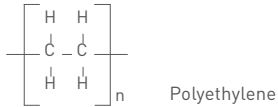
The composting of PLA is not recommended or even prohibited in some countries. Bioplastics are not desirable in composting plants because they have no value-adding properties, and are seen as an interfering substance in the process, one reason being that they cannot be distinguished from conventional plastics.

	Advantages	Disadvantages
Origin and manufacturing	renewable raw material	- raw material chemically modified - does not grow in Europe, long transport routes - fertilizers and pesticides used - corn and sugar cane are grown in monocultures, which endangers biodiversity - often contains fossil-based additives
Disposal		- releases CO₂ during incineration - not recyclable - In case of littering as harmful to the environment as conventional plastic - not composted in reality
Properties	- fat-repellent - water-repellent - acid-resistant - lockable with lid - transparent possible	- temperature sensitive, not for hot drinks (except CPLA) - limited storage period - affected by the EU Single-use Plastics Directive just like other plastics



Bio PE, often called Green PE, has identical properties to the plastic PE (polyethylene) with the difference that Bio PE is bio-based, i.e. the raw material consists of sugar cane or corn starch. The cultivation of sugar cane and corn starch mainly takes place in South and North America and is only possible in monocultures. Therefore, this always implies the risk of rainforest deforestation and requires a high use of pesticides. Ethanol is produced from the raw materials (sugar cane or corn), which in turn is converted to Bio PE by polymerization.

This Bio PE can then be recycled with the fossil-based PE because it has the same chemical structure and the same properties.



If possible, PE should be disposed of via plastic recycling. If sorting infrastructure is available in the respective country, PE is separated in the sorting system and can then be used as recycled material.

Now this recycled material can be downcycled to a drain pipe or flower pots. It is not possible to produce a product from it that is to come into contact with food for food safety reasons.

Advantages

Disadvantages

Origin and manufacturing

- from renewable raw materials

- pesticides and fertilizers in cultivation
- does not grow in Europe, long transport routes
- cultivation in monocultures and therefore endangers biodiversity

Disposal

- combustible without pollutants
- recyclable (like PE)
- promotes circular economy

- releases CO₂ during incineration
- in case of littering harmful for the environment just like other plastics

Properties

- fat-repellent
- water-repellent
- acid-resistant
- transparent

- affected by the EU Single-use Plastics Directive



Fossil-Based Plastics

In the past, most of the single-use products were often made from fossil-based plastics such as PE (polyethylene), PS (polystyrene), PET (polyethylene terephthalate) or PP (polypropylene). However, the goal of the EU Commission is to reduce the use of plastics.

Mineral oil is found in various places around the world. It can come from oil drilling platforms in the Baltic Sea and also from the rainforest in the Amazon region. The oil is distilled in the refinery and separated into various components. A part of it, the naphtha, is then broken down into the components required for the production of plastics by the so-called cracking.

Depending on the type of plastic, various chemical processes (e.g. polymerization or polycondensation) ensure that the individual molecules “monomers”, combine to form polymers (plastics). Additives are often added to improve the material properties.

The resulting plastic granulate can be melted again and then by injection molding or by thermoforming, be made into disposable cups, cutlery, etc.
After use, plastics should be disposed of via plastic recycling.

The plastics are then separated into different fractions in the sorting system. Depending on the type of plastic, shape, size and nature, the products have either a good recyclability or are not recyclable at all. Some disposable products are also packed with a PE film to protect them from dirt. This is easily recyclable and should be disposed of via plastic recycling. Disposal in residual waste, i.e., energy recovery should be seen as the last option according to the waste hierarchy.

Recycled Plastic from post-consumer collection should not come into contact with food. Therefore, a single-use plastic cup cannot become a single-use plastic cup again. The plastics can only be down-cycled to products that do not come into contact with food such as cleaning bottles.



	Advantages	Disadvantages
Origin and manufacturing		▪ from fossil raw materials ▪ causes environmental damage from oil production
Disposal	▪ recyclable (depending on the type of plastic) ▪ partially promotes circular economy	▪ releases CO₂ during incineration ▪ in case of littering harmful for the environment
Properties	▪ fat-repellent ▪ water-repellent ▪ acid-resistant ▪ lockable with lid ▪ transparent possible	▪ affected by the EU Single-use Plastics Directive ▪ not suitable for the oven ▪ limited heat stability



rPET

RPET stands for recycled PET. RPET can be used for bowls, cups and lids.

At least 95 % of the recycled material comes from the separate deposit bottle collection. For reasons of food safety, only a percentage of 5 % is currently allowed from non-food post-consumer material.

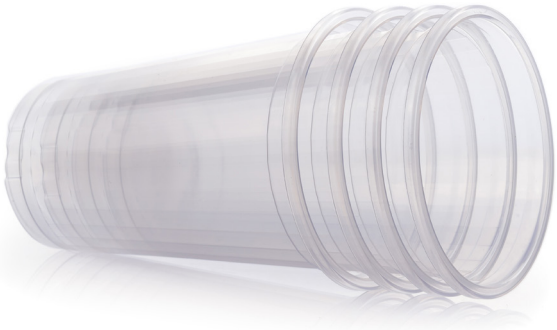
After the bottles have been collected separately, they are cleaned, washed and processed into flakes in a PET processing system. These flakes can then be remelted and processed into new PET products such as cups, menu dishes or back to PET

bottles. Often however, a certain proportion of fresh material has to be added to meet qualitative requirements.

After usage by the consumer, the RPET packaging should be disposed of via plastic recycling. Bottles are then separated from other PET packaging in the sorting system, if available in the respective country. The majority of these other PET packaging are used for energy recovery (incineration). In the best case, it will be downcycled to packaging tape or textile fibers.



	Advantages	Disadvantages
Origin and manufacturing	▪ made from recycled material ▪ energy saving through the use of recycled material	▪ originally from fossil raw materials, fresh fossil raw materials must continue to be added ▪ environmental damage from oil extraction
Disposal	▪ theoretically very good recyclability ▪ promotes circular economy	▪ releases CO₂ during incineration ▪ downcycling (no closed loop) ▪ not always recyclable ▪ in case of littering harmful for the environment
Properties	▪ fat-repellent ▪ water-repellent ▪ acid-resistant ▪ suitable for freezing ▪ lockable with lid ▪ very high transparency	▪ affected by the EU Single-use Plastics Directive



Aluminium

Aluminium is mainly used in menu trays for delivery and take-away services, because the properties of aluminium make it easy to reheat and keep food warm.

Aluminium is extracted from the ore bauxite. The largest bauxite reserves are in the tropical belt. In addition to the risk of rainforest clearing, a toxic red mud is produced during mining, which is very harmful to the environment.



In order to produce aluminium, complex and energy-intensive chemical processes are necessary. Aluminium oxide is extracted from the bauxite with sodium hydroxide solution. Pure aluminium is then obtained from it by a process called electrolysis.

This aluminium can then e.g. be processed into packaging or aluminium foil. This usually happens in the industrialised countries themselves and not in the mining area. Big aluminium blocks are made into thin sheets in several rolling steps. Then, from these thin sheets, aluminium trays can be deep-drawn and punched out.

After usage by the consumer, aluminium should be disposed of in the recycling bin. In the sorting systems, aluminium can be separated from plastics and other magnetic metals by an eddy current separator. The use of this recycled aluminium requires up to 95 % less energy than the extraction of primary aluminium.

	Advantages	Disadvantages
Origin and manufacturing		▪ mining in rainforest areas ▪ environmental damage caused by bauxite mining ▪ toxic waste products ▪ very high energy requirements ▪ long transport routes ▪ use of chemicals
Disposal	▪ very good recyclability (theoretically unlimited)	▪ in case of littering harmful for the environment just like plastics
Properties	▪ waterproof ▪ greaseproof ▪ suitable for the oven ▪ microwaveable ▪ suitable for freezing ▪ lockable with lid ▪ not affected by the EU Plastic Ban Directive	▪ sensitive to acidic and saline products ▪ health risk from possible transmission of aluminium into the food



Chapter 4

Ecolabels



There are various labels with which the materials of single-use products can be certified. The most important ones in the disposables' context are summarized below.

To evaluate the labels in matters of transparency, credibility, social issues and ecology, for example the following websites can be used:

<http://www.ecolabelindex.com/>
<https://www.siegelklarheit.de/>



4.1

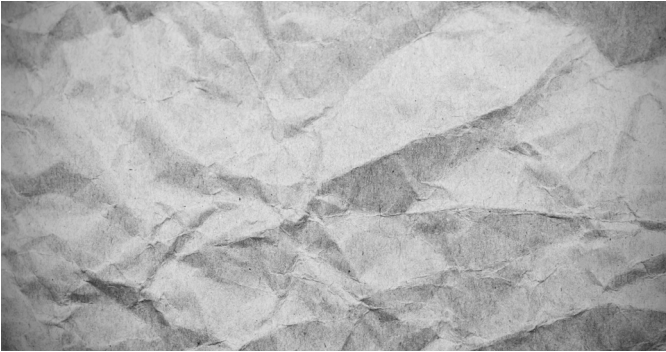
Blue Angel

The blue angel is the oldest environmental label in the world and has existed since 1978. The label of the Federal Government of Germany is awarded by an independent jury, which is made up of voluntary members from environmental and consumer associations, trade and industry.

The products that can be certified today range from recycled paper and toothbrushes to office equipment. That is why there are different requirements for the different product groups in order to receive the Blue Angel.

The aim of the Blue Angel is to label products that save resources and reduce environmental pollution. The label places demands on the manufacturing and origin of the products. In the case of paper, for example, the label identifies products that are made from 100 % recycled paper (PCR), are low in pollutants and are energy and water-saving.

More information about the Blue Angel
www.blauer-engel.de/en



4.2

FSC®

FSC® stands for "Forest Stewardship Council" and exists since 1993. It is an international certification system for more sustainable forestry and therefore only deals with the raw material origin of wood and paper products. Depending on the label, a certain percentage of the products must come from FSC-certified forest or consist of recycled material. The goal of FSC® is the ecologically sustainable, socially beneficial and economically profitable management of forests, worldwide.

The same certification criteria and principles apply in all countries. These are specified by the respective national working groups. Nature conservation and social organizations are also involved in setting these national standards. The certificate is then issued by the national certification bodies authorized by the FSC®.

As of November 2019, around 200 million hectares of forest worldwide are certified according to FSC® standards (about 10 % of the world's forest area). About 64 % of these forests are near-natural forests. Around 19 % of all FSC-certified areas are in the tropics.

The following criteria are taken into account when certifying forests:

- compliance with the law
- workers' rights and working conditions
- rights of indigenous people
- relationships with the local population
- environmental goods and environmental impact
- management
- monitoring and evaluation
- special protection values
- implementation of management measures

More information about FSC
<https://fsc.org/en>

FSC® 100 %:
Requires 100 percent origin from certified sources. The certification is mainly used in solid wood products.

FSC® Mix:
Allows a mix of certified forest and non-certified forest, but the product must consist of at least 70 % FSC-certified or recycled material, i.e. up to 30 % can come from unsustainably managed forests.

FSC® Recycled:
Requires that the product consists of 100 % waste paper, of which at least 85 % must be post-consumer material.



4.3

PEFC™

PEFC™ exists since 1999 and stands for “Programs for the Endorsement of Forest Certification Schemes”.

Like the FSC label, the PEFC label is a certification system for sustainable forest management and only deals with the raw material origin of wood and paper products. A certain percentage of the products must come from certified forest or consist of recycled material, depending on the type of label. The PEFC label aims to improve forest management in terms of social, ecological and economic standards.

The national working group authorizes national certification bodies. This certification body then issues the certificate. Worldwide, 325 million hectares of the forests are PEFC-certified.



The following criteria are taken into account when certifying forests:

- legal and other requirements
- forest resources
- health and vitality of the forest
- forest production function
- biodiversity in forest ecosystems
- protective functions of the forests
- socio-economic functions of forests

More information about PEFC
www.pefc.org/

4.4

EU-Ecolabel

The EU Ecolabel was launched by the European Commission. It is based on an EU regulation and exists since 1992. In each country participating in the EU Ecolabel, a national Competent Body is available.

The EU Ecolabel is awarded to products and services that have a lower environmental impact than comparable products. Products from paper carrier bags to electrical equipment and campsites can be certified. There are different requirements depending on the product category.

The following criteria are taken into account when awarding paper products:

- paper substrate
- fibers from sustainable forestry (certified according to FSC® or PEFC™) or recycled material (for hygienic paper)
- waste management in production
- bans or restrictions on certain hazardous substances
- recyclability
- emissions in water and air
- power consumption

More information about EU Ecolabel
<https://ec.europa.eu/environment/ecolabel/>





4.5

Nordic Swan Ecolabel

The Nordic Swan Ecolabel is a state environmental label of the Nordic countries. The eco-label was created in 1989 by the Nordic Council of Ministers and consists of a jury with representatives from all countries.

It can be used to certify a wide range of products, from packaging to cosmetic products to buildings. In the disposables' context the certifications for "disposables for food" and for „tissue paper“ are particularly relevant.

The following criteria are taken into account when awarding the Nordic Swan Ecolabel Disposables for Food:

- material composition (products must be at least 90 % bio-based or made from recycled plastic)
- certified raw materials (at least 50 % according to FSC® or PEFC™)
- restrictions on additives
- disposal (products must actually be compostable or recyclable in the Nordic countries)
- power consumption
- traceability

Examples for certifiable products with the Nordic Swan Ecolabel for Disposables for Food are coffee mugs, wooden cutlery, pizza boxes and bakery bags.



The following criteria are taken into account when awarding the Nordic Swan Ecolabel Tissue Paper (hygiene paper):

- certified raw materials (at least 50 % according to FSC® or PEFC™ or 75 % recycled material)
- energy consumption and CO₂ emissions
- emissions in water and air (e.g. chemicals)
- traceability
- packaging (of the hygienic paper)
- quality and legal requirements

Examples for certifiable products are napkins, toilet paper, kitchen roll and towel paper.

More information about Nordic Swan Ecolabel
www.nordic-ecolabel.org

4.6

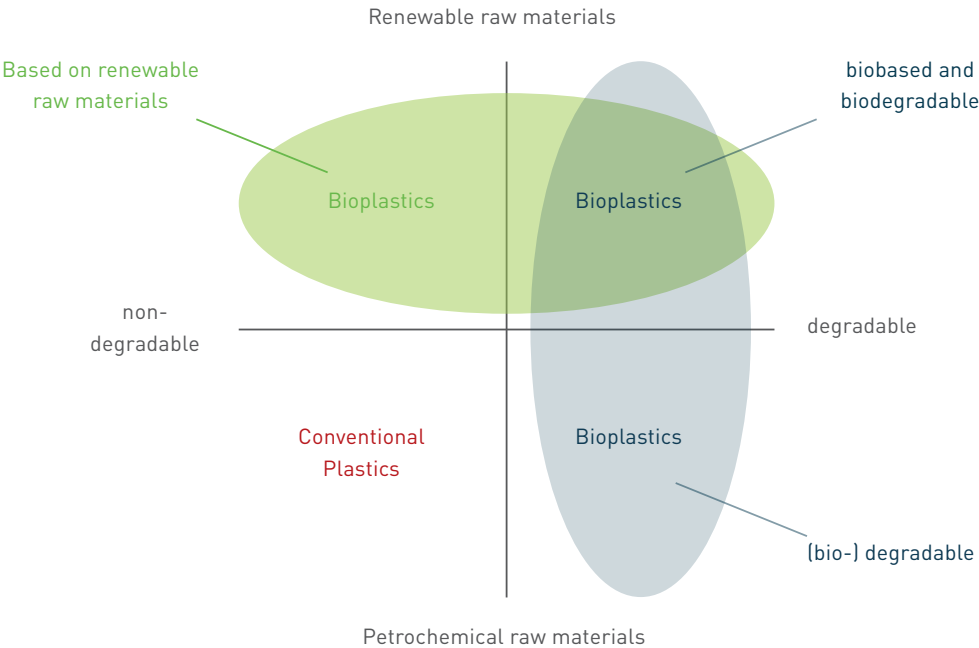
Overview of Ecolabels





Glossary

biobased	According to EN 16575, biobased means that a product is made entirely or partially from renewable raw materials (biomass).
bio plastics	Bioplastics can either be biobased and biodegradable or only one of the two, i.e. biobased or biodegradable.



biodegradable	The breakdown of an organic chemical compound by microorganisms in the presence of oxygen to carbon dioxide (CO ₂), water and mineral salts of other present elements (mineralisation) as well as new biomass or in the absence of oxygen to carbon dioxide, methane, mineral salts and new biomass.
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downcycling	Downcycling is a form of recycling in which the material value decreases with each reprocessing and only a lower-quality product can be made from it. For reasons of food safety, food packaging can usually only be downcycled.
sustainable	The demands and needs of the present should be met without compromising the ability of future generations to meet their needs. (cf. Final Report of the Commission „Our Common Future“, United Nations 1987, p.34)
renewable raw material	Renewable raw materials are organic raw materials that come from agricultural and forestry production and are used by people for further purposes outside of the food and feed sector.
oxo-degradable plastic	Plastic material to which additives have been added to catalyze the breakdown of the plastic material into microparticles (the plastic is only fragmented into small particles and is not biodegraded).
polymerisation	Chemical reaction for plastic production
post-industrial-recycled material	Post-industrial recycled material (PIR) or pre-consumer recycled material is the waste that is generated during the industrial production of products, i.e. these recycled materials were not yet in circulation as a product / packaging.
post-industrial-recycled material	Post-consumer recycled material (PCR) is the recycled material that results from the recycling of consumer waste.
recyclable	Recyclable means that there is a real material stream for the packaging (material is collected, separated and actually made into a new product). it should only be used if this is the case and not if it's only recyclable in theory. There is a lot of misleading information on the market.
recycling	When we talk about recycling, we mean technical recycling (not recycling via the biological cycle through composting).
acid-resistant	Resistant to acidic food such as pineapple



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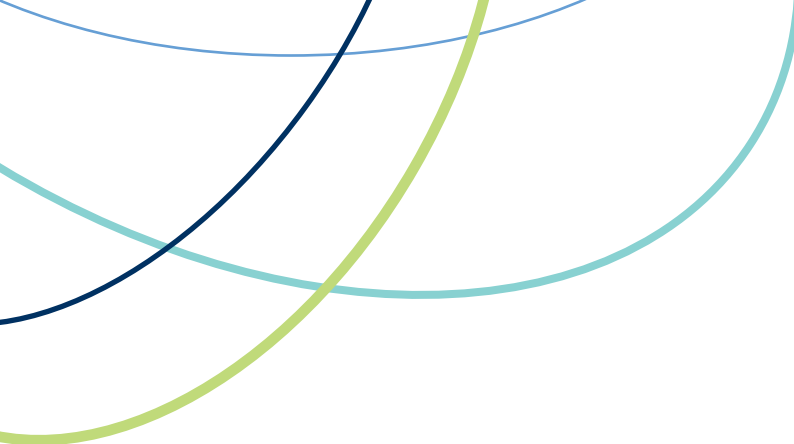
Publisher: INPACS GmbH · Mizarstr. 6 · 12529 Schönefeld, Germany
Contact: Phone: + 49 (0) 30 6341494-0 · e-mail: info@inpacs.com

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Updated version March 2021



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