Netherlands Institute
for Sustainable Packaging

Background document

KIDV Recycle Check for Rigid Plastic Packaging 2023

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Netherlands Institute
for Sustainable Packaging

KIDV Recycle Check for Rigid Plastic Packaging - 2023
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This Recycle Check is updated annually. Please visit KIDV's website for the latest version.

If you have any questions about this Recycle Check, please contact KIDV.

KIDV would like to thank the sector organisations, producers and importers of packaged products and sorters and recyclers of rigid plastic packaging for their contributions to the realisation of this Recycle Check.

KIDV created this document with the utmost care and attention. Nevertheless, should the document be incomplete or incorrect in any way, please let us know. KIDV assumes no liability for any damage resulting from or related in any way to the use of this document.

KIDV also rejects any responsibility for claims made based on this Recycle Check.

1. Introduction

Since 2019, the Netherlands Institute for Sustainable Packaging (KIDV) has been producing Recycle Checks that allow companies to assess relatively easily and quickly whether and to what extent their packaging has good recyclability. In recent years, we have made KIDV Recycle Checks for rigid and flexible plastic packaging, as well as packaging made of paper, cardboard, glass and metal. The KIDV Recycle Checks align with recycling checks and guidelines from other countries and international organisations, such as Plastic Recyclers Europe (Recyclass), PETcore Europe and European PET Bottle Platform (EPBP).

The Recycle Checks are based on the current system of collecting, sorting and recycling packaging materials in the Netherlands. The processes examined are those used to process the largest tonnage of household waste: what happens to packaging after a consumer disposes of it at home, and how is it processed in sorting and recycling plants?

Occasionally, local initiatives, market developments or innovations can affect the recyclability of packaging. KIDV monitors all these developments and market changes to the best of its abilities. If necessary, the Recycle Checks will be updated in close conference with the relevant parties. This is done if and when new developments apply to the majority of the packaging used in the Dutch market.

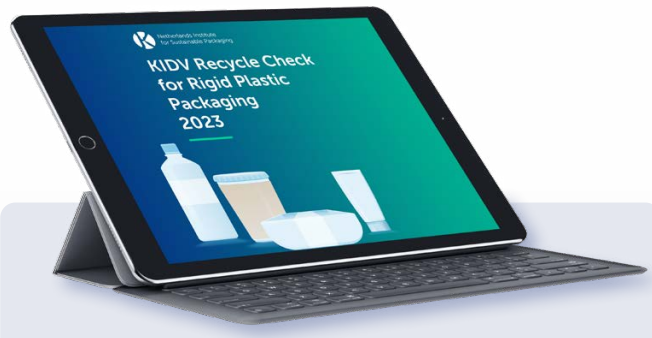
The KIDV Recycle Checks apply to packaging that ends up in household waste or similar waste streams, such as waste from the hospitality sector, offices, retail and service businesses. They do not apply to packaging that does not belong in household waste, such as small chemical waste. See also notes chapter 2 - Definitions.

Updated KIDV Recycle Check for Rigid Plastic

The 2023 edition of the KIDV Recycle Check for Rigid Plastic Packaging has been redesigned to make it more user friendly. Next to that, the contents have been updated. The redesigned Recycle Check consists of two parts:

1

The Recycle Check, used to assess packaging for recyclability (good, reasonable, limited and non-recyclable).



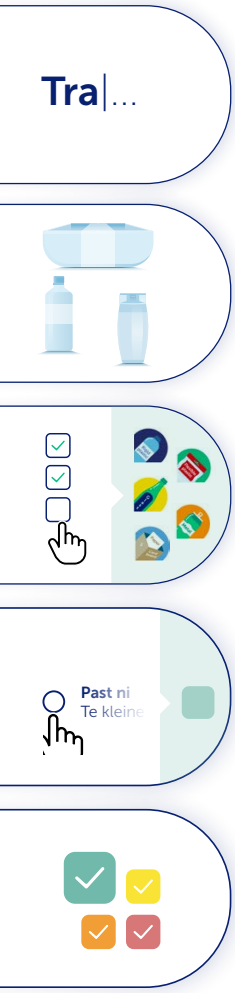
2

Background document with information on collection, sorting and recycling processes. The background document also contains instructions on how to test certain properties of packaging. It can also be used as a reference document and features guidelines for improving the recyclability of packaging.

Legislation

This document takes into account current European and national legislation (autumn, 2022). In late 2022, the European Commission published a draft version of the new Packaging and Packaging Waste Regulation. This regulation has not yet been finalised, but, at first sight, it appears to contain several specific directions with regard to recyclable packaging. Keep this in mind if you invest in the modification of your packaging. For a current overview of laws and regulations, view the Packaging Timeline on the KIDV website (only available in Dutch).

User Manual



Step 1
Open the checklist and enter some information about the product you will be assessing.

Step 2
Continue to the overview page. Based on the explanation, identify and select the disposable unit(s) for the specific product-packaging combination you want to assess. You have to assess each disposable unit separately

Step 3
Next, complete the appropriate checklist for each disposable unit. While answering the questions, please refer to the background document for further explanation. Important: the 2023 version of the Recycle Check can only be used to assess disposable units in the 'rigid plastic packaging' category. For other packaging materials, please use the 'old' Recycle Checks until they are updated.

Step 4
When you have answered all the questions in the checklist, you can finalise it. You will automatically be redirected to the overview page where you will find the final recyclability score of the disposable unit in question. If you have selected multiple disposable units, you can proceed with the following checklist. Important: data are saved locally. If you stop midway through a checklist, you will able to resume later if you use the same computer.

Step 5
If you wish, you can export your results to a PDF file from the overview page.
You can then save the file and/or share it with stakeholders.

The checklist features several complex questions. These questions are more difficult to answer without further testing, but by performing these tests, you can increase the recyclability score of the disposable unit. Complex questions are indicated by the symbol: ❗
You may have to perform a test to answer these questions. Where possible, the Recycle Check will refer you to an available protocol. Not all protocols are available yet, but more will be developed in the first half of 2023. The latest information about protocols can be found here.

Answer all the questions first. Only then can you determine whether a test can improve the overall score of recyclability. Sometimes, criteria found later on in the checklist will eliminate the improvement on overall recyclability. For example: if you have to perform a sortability test and find out later that the disposable unit is not optimally recyclable. However, it may still be wise to do a test, so you know how your disposable unit scores on this particular aspect.
If you use the Recycle Check in order to apply for the modulated fee from the Packaging Waste Fund (Afvalfonds Verpakkingen) and need a test to show that you qualify for a discount, contact the Packaging Waste Fund first. They will tell you whether you have to do a test. You should still contact the Packaging Waste Fund even if you have already had another party, e.g. Recyclass, perform a test.

2. Definitions

For an overview of all terms mentioned in this document, see the Packaging Glossary on the KIDV website. Several important terms and definitions are explained below.

Recyclability

The purpose of the KIDV Recycle Checks is to help businesses make their packaging more circular. The vision set out by the Ellen MacArthur Foundation serves as the basis for this endeavour:

> *'A circular economy is one that is restorative and regenerative by design and aims to keep products, components and materials at their highest utility and value at all times'*
>
> MacArthur, 2015

KIDV has translated this into the following definition (components).

A disposable unit of packaging (see chapter 3) must meet four conditions to have good recyclability:

1. The composition of the disposable unit must be such that it is collected or picked up by approved waste collectors.
2. The disposable unit must be sorted and/or bundled into pre-defined streams for recycling processes.
3. The material* must be processed in a recycling process on an industrial scale**, and raw materials must be recovered.
4. The recovered raw material must have a uniform composition and can be used to produce new packaging or products.

* *At least 70% of the material of the disposable unit must be the target material for the recycling process.*

** *Industrial scale means that at least 50% of the collected packaging is sorted correctly and processed by at least two recyclers.*

Producers of innovative materials must be able to demonstrate that these materials can be collected and sorted in sufficient quantities and that they are compatible with existing industrial recycling processes or that new processes are available on an industrial scale.

In the checklist, we distinguish between optimal recyclable, reasonable and limited recyclable, or even non-recyclable packaging. The following categories are indicated using colour-coded boxes:

Non-recyclable
Packaging that contains a disruptor, a substance that interferes with the recycling process.

Limited recyclability
Packaging that has limited recyclability,
- may end up in the mixed stream (a mixture of lots of different plastics) after sorting with the resulting plastic granulate having only a limited scope of application;
- may not always be sorted into the right mono-stream;
- or may contain components that disrupt the recycling process and are difficult to remove.

Reasonable recyclability
These questions apply to packaging for which a small step still has to be taken before it can be classified as being **optimal recyclable**. This packaging does arrive at the recycler as a well-sorted mono-stream, but something in the packaging has an impact on the quality of the recyclate or the effectiveness of the process..

Optimal recyclability
All aspects of this packaging make it optimal for recycling and make it **good recyclable** according to the aforementioned definition used in the KIDV Recycle Check.

The Recycle Checks are based on the systems used to collect, sort and recycle rigid plastic packaging in the Netherlands in 2022. The processes examined are those used to process at least 50% of all household waste.

Household Waste and Residual Waste

The KIDV Recycle Checks apply to packaging that ends up in household waste or similar waste streams, such as waste from the hospitality sector, offices, retail and service businesses. They do not apply to packaging that does not belong in household waste, such as small chemical waste. Examples include packaging for medication, packaging made of EPS (Styrofoam), padding and cushioning materials, packaging for paint and glue or sealant tubes. Municipalities in the Netherlands decide how their residents can dispose of waste, implementing either source or post-separation.

With source separation, residents are asked to perform the first step in the sorting process themselves by discarding paper and cardboard, glass and PMB (plastic, metal and beverage cartons) in separate containers. What remains is residual waste.

With post-separation, residents throw all waste into one bin. After the municipality collects the waste, it is sorted for recycling by a specialised company. You can use the Waste Separation Guide by Milieu Centraal to check which bin to use for your packaging (only available in Dutch).

Figure 1 *Examples of packaging that belongs in residual waste.*

Commercial Waste

The collection of commercial waste is usually arranged separately by waste companies and is often subject to additional quality requirements. The Recycle Check does provide a good basis of information with regard to packaging that ends up in this stream after use.

Rigid plastic packaging, for example, is still considered to have *good recyclability* if it ends up in commercial waste and if it meets the requirements set out in this Recycle Check.

Deposit

The KIDV Recycle Check for Rigid Plastic Packaging can be used for bottles that fall under the deposit return scheme. On the website of Statiegeld Nederland, you'll find background information about and requirements for recycling bottles under the deposit return scheme. See www.statiegeldnederland.nl (only available in Dutch).

Modulated fee

If you are required to pay a packaging waste management fee to the Packaging Waste Fund (Afvalfonds Verpakkingen) and your rigid plastic packaging has good recyclability according to this Recycle Check, you can contact the Packaging Waste Fund and have them assess whether your packaging qualifies for a lower contribution fee.

Visit the website of the Packaging Waste Fund for more information.

KIDV Recycle Checks

KIDV also has Recycle Checks for flexible plastic packaging, glass packaging as well as for paper and cardboard packaging.

3. Determining Disposable Unit(s) and Components

Packaging may consist of one or more disposable units:

- When packaging is disposed of after use, the entire packaging may be disposed of in one go (one disposal moment). In this case, the packaging constitutes a single disposable unit.
  ***Example:** a flask of dishwashing liquid thrown away with cap and labels at the same time.*

- Regularly, packaging is not discarded in its entirety at once, but in separate parts and at separate times.
  ***Example:** a cardboard box containing four granola bars separately wrapped in plastic film/wrap. Consumers take a bar from the box at different times/places. Consequently, the wrappers are also discarded at different times and places, as is the box. In this case, the packaging, which consists of a box and four wrappers, is made up of five disposable units that each have to be assessed for recyclability. In this example, you would have to use the Recycle Checks for paper and cardboard packaging and for flexible plastic packaging.*

The rules for identifying the number of disposable units:

1. A packaging or packaging component is considered a single disposable unit if the consumer discards the packaging/packaging component as a whole. If the consumer has to remove one of the components entirely before using the product, the packaging consists of two or more disposable units.

2. It must be easy for consumers to separate the packaging components without requiring any tools, such as a pair of scissors.

3. There are clear instructions on the packaging showing that the components should be disposed of separately. You can use the logos of the Disposal Guide for this purpose. The packaging should also state clearly how users can separate the components.

4. It can reasonably be assumed that the consumer will separate the packaging components and discard them separately.

Compliance with the final requirement can be demonstrated by studying users/consumers' behaviour in practice. If it proves impossible to demonstrate that consumers will separate the packaging components and discard them separately, the packaging will be considered a single disposable unit. In that case, the Recycle Check for the main component of the packaging can be used for the packaging/disposable unit as a whole.

Full-Body Sleeve with Tear Strip

For packaging with a full-body sleeve featuring a tear strip, the sleeve is not considered a separate disposable unit but rather a sub-component, provided that the product can be used without removing the sleeve.

The same applies to cardboard sleeves applied around plastic cups. In either case, the sub-component should be evaluated as a label or sleeve.

Pots and Trays with a Film Cover

For rigid packaging with a flexible film cover, it is often difficult to determine whether the film is a disposable unit of its own or part of another disposable unit.

Some films have to be removed in their entirety in order to use the product, and other films are very easy to remove and/or detach virtually automatically after the packaging is opened. They come off so easily that they could also come off during the sorting process, making them a separate disposable unit. In that case, the film is a flexible plastic main component that has to be assessed with the Recycle Check for flexible plastic packaging.

Some film covers do not remove as easily and may remain fully or partially attached to the pot or tray after use, such as meat packaging with a firmly attached film. In that case, the film should be assessed as a sub-component of rigid packaging, using the appropriate Recycle Check.

Main Component and Sub-Components

To assess the recyclability of a disposable unit, you must first determine its main component(s). The material used for the main component is the so-called target material for recycling. The target material determines which Recycle Check you should use to assess the recyclability of the disposable unit. In addition to the main component, a disposable unit will also often have sub-components. ***Example:** the bottle is the main component of this bottle of dishwashing liquid, while the cap and label are sub-components.*

Example 1
Bottle (main component) with cap and label (sub-components) - one disposable unit.

Example 2
Box (main component) with 4 granola bars (also main components).

Dimensions of a Disposable Unit

Packaging is sorted by size in a sorting system, using a large, rotating drum with differently sized holes that acts as a sieve. This method separates packaging that is either too small or too large for the sorting process from all other material. Oversized and undersized packaging is usually not offered for recycling, even though it would, in theory, be recyclable.

Smaller than 3 cm

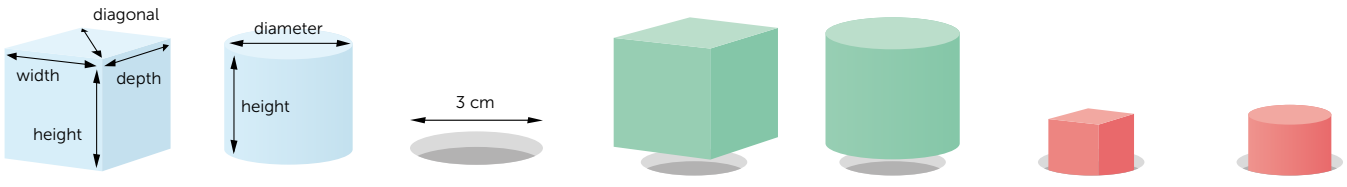
Packaging is too small to be sorted if it can pass through a round opening with a 3-centimetre diameter, which is the smallest hole in the sieve. These types of packaging are removed from the sorting stream because this fraction is often heavily contaminated. Furthermore, the fraction is made up of many different types of material, which are difficult to separate using common techniques.

In some cases, the small fraction is sorted again to separate and recycle small components, like lids and caps. This process specifically targets optimal recyclable parts.

Larger than 5 litres

If the volume of the packaged product is greater than 5 litres, the packaging is removed from the sorting stream and is usually not recycled. It is worth noting that this type of packaging can usually be recycled as part of an industrial waste stream.

Some waste sorters, especially those that employ post-separation techniques, cut up the incoming waste stream into smaller pieces. This makes it possible to sort packaging that was originally too large to be recycled. This is not particularly common at the moment. Once this technique is used on a large scale, this Recycle Check will be updated accordingly.



Sortable
Height, width, depth, diagonal and/or diameter greater than 3 cm

Not sortable
Height, width, depth, diagonal and/or diameter less than 3 cm

Cylindrical and Conical Packaging

A cylindrical or round plastic container, such as a bottle or jar, is normally flattened in a so-called compactor after collection. This is very convenient for the sorting process because it keeps the packaging from rolling over the belt. Packaging that cannot be flattened, on the other hand, hampers the sorting process because it is transported on a conveyor belt. Cylindrical packaging tends to roll when it reaches the belt and can therefore not be processed properly. When the packaging is scanned with Near Infra Red technology and sorted into the right container with a blast of air, cylindrical units of packaging tend to behave very erratically and often do not end up in the correct stream.

TEST
Can this cylindrical or conical packaging be compressed?

Step 1: Put your foot on the packaging (empty or not), press down and take your foot off. If the packaging was not flattened or springs back into shape, there is a good chance that it will keep its shape during the collection and sorting process, which means it cannot be sorted properly. If you're unsure of the outcome of this test, use the NTCP Pollution and Compression Protocol to simulate the collection and sorting step (available soon via the KIDV-website).

Step 2: If the packaging was flattened and stays flat, it can be sorted properly. Change the answer to this question to 'optimally recyclable' in the checklist.

4. Considerations for Recyclability of Main Component

This section describes the recyclability of the main component. A distinction is made between PET, PE or PP and all other materials. The difference between mono-materials and multi-materials is also explained in greater detail.

The Weight of the Main Component, Relative to the Total Weight of the Disposable Unit

In addition to the main component, packaging often consists of sub-components such as caps, labels, tags, film covers and sleeves. The purpose of the sorting process is to sort the main component which is the target material of the recycling company in question. The sub-components - depending on their composition and size - can sometimes be recycled separately as a so-called secondary stream.

For the sorting and recycling process to be effective, the main component must account for 70% of the total weight of the packaging. In other words, the sub-components may not make up more than 30% of the total weight of the packaging.

Weight empty main component / Weight disposable unit * 100% ≥ 70

The Material Composition of the Main Component:

The material composition of the main component affects the recyclability of the respective disposable unit. The use of different types of materials, coatings, fillers and additives affects how the material can be processed by recyclers.

Optimally Recyclable PET, PE and PP Mono-Materials without Additives

If the main component is made of mono-material PET, PE or PP without any additives such as coatings or barriers, it can be assumed that it is properly recyclable.

In plastic sorting installations, packaging is first sorted by shape (flexible or rigid), by type of material (plastic, metal, beverage carton) and then by type of plastic.

Rigid plastic packaging are sorted by identifying the main component and its constituent plastic: PP, (HD)PE or PET. This also includes Bio-PE and bio-PET, as they have the same molecular structures as PE and PET, respectively.

Rigid plastic packaging that is not made of PE, PP or PET is sorted in a mixed stream. These types of packaging are not easily recyclable. Examples include PolyCarbonate (PC), PolyStyrene (PS) and PolyLacticAcid (PLA).

The percentage of these materials in the total volume of the household waste stream is relatively small. Due to how difficult it is to sort and recycle these materials in a cost-effective manner, this is not done on a large scale.

If the main component contains layers of different materials or additives such as coatings or barriers, the impact of these layers or additives on the recyclability of the component must be assessed.

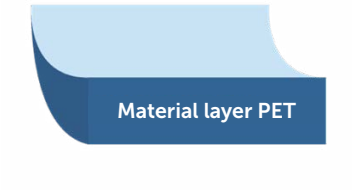
To assess recyclability, consider the following:

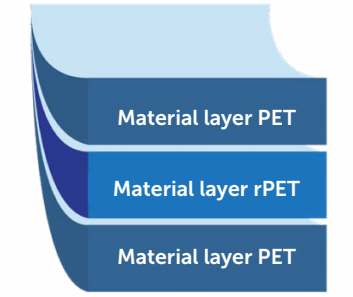
- Does the main component have multiple layers or does it feature a label or a sleeve? This section is about multi-layer materials. Labels or sleeves are added to the packaging at a later stage of the packaging process, possibly with the use of an adhesive. They do not usually cover the entire surface of the main component. For more information about sleeves and labels go to section 5.
- Does the main component have multiple layers or does it feature a coating? A layer usually has a thickness of more than 1 micrometre (1µm=10-6m), while a coating is usually several nanometres thick (nm=10-9m). This is important, as it helps determine whether the main component consists of a mono-material or not.

The Difference Between Mono-Materials and Multi-Materials

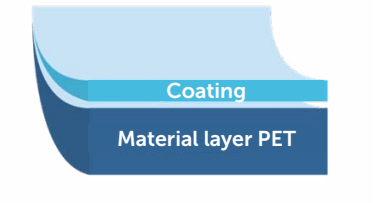
Mono-Materials

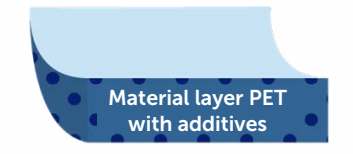
Mono-materials are made of one type of polymer. This can either be a single layer of a particular polymer or multiple layers of the same polymer (e.g. two outer layers of virgin plastic with a middle layer of recycled plastic made of the same polymer).





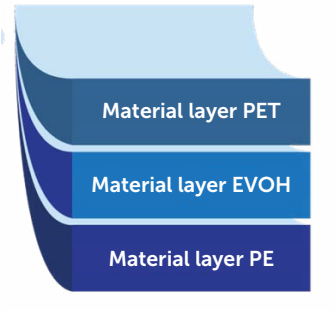
Mono-materials do not have any layers made of other materials, but may feature prints, coatings or additives.





Multi-Materials

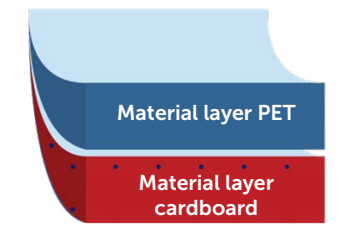
Multi-material packaging consists of different materials joined together by adhesives, coextrusion or lamination. Material additions such as printing may be added to the layers. The layers that make up a multi-material are very difficult or impossible to separate



There are many different types of multi-materials:

- **Multi-materials consisting of layers of different plastics, e.g. combinations of PET and PE.**
  Multi-materials made of different plastics affect recycling because these materials cannot be separated. When a combination of different plastics is introduced into the recycling process, its impact on the material properties of the recyclate is more difficult to predict. The impact of mono-materials is easier to predict. In some multi-materials, the properties of the plastics are so far apart that they cannot be processed together, such as combinations of PET and PE.

- **Multi-materials consisting of a combination of plastic and non-polymer layers.**
  Examples include packaging made up of combinations of PP with a layer of cardboard, such as for frozen vegetables. To determine which Recycle Check to use, identify the main material used in the packaging. The properties of these composite materials are usually so far apart that it is difficult to recycle them together.



Materials that Impact Recycling

The main material of a disposal unit may contain substances that disrupt the recycling process. Some substances only have a negative impact, while others are true disruptors.

Examples of disruptors include PET-G, PVC, PVdC, oxo-degradable materials, elastomers, silicones and other rubber-like substances.

Disruptors

PETG

PETG is PET with added glycol, is a substance that disrupts the recycling process. During the recycling process, PET flakes are washed and dried. During the drying process, however, the added glycol becomes sticky, creating blockages further down the process and thus hindering the recycling of PET. This is true for both transparent and coloured PET.

PETG is widely used for highly detailed PET bottles, pots and blisters, but it can also be used in full body sleeves. PETG also disrupts the recycling of APET (amorphous polyester). The majority of PET bottles and trays is made of APET.

PVC and PVDC

PVC (polyvinyl chloride) and PVdC (polyvinylidene chloride) used in packaging material disrupts the recycling of other plastics. If PVC ends up in the recycling stream of other plastics, e.g. as a label, it will trigger an unwanted chemical reaction that produces hydrochloric acid, which may damage the recycling equipment. The same applies to PVdC, which is mainly used as a barrier in films.

PVC is widely used in (imported) products and in transparent plastic boxes. It is also widely used as tamper evidence on closures, in blisters or as a sleeve around rigid packaging. PVC in applications other than packaging, also known as vinyl, is easily recyclable when processed as a separate stream. PVC recyclate is widely used and features in PVC sewage pipes, for instance.

Oxo-degradeerbaar

Oxo-degradable or oxo-biodegradable plastics are plastics containing additives that disintegrate into small pieces of plastics (microplastics) when exposed to ultraviolet light and oxygen. These additives can be added to all plastics. Oxo-degradable plastics are mainly used in carrier bags and pouches, but they can also be found in rigid plastic applications. If oxo-degradable materials end up in recycling streams, they affect the quality of the plastic recyclate, making them disruptors.

Oxo-degradable packaging was banned in the Netherlands with the introduction of the Packaging Management Decree 2014 (only available in Dutch).

The European Union has banned the use of oxo-degradable material in packaging that falls under the scope of the Single-Use Plastics Directive per 3 July 2021.

Elastomers, Silicones and Other Rubber-Like Substances

Packaging with components made of elastomers and silicones, acrylates and other rubber-like plastics may disrupt the recycling process. The same applies to packaging used for products that contain silicones.

Elastomers such as silicones, acrylates and other rubber-like plastics are used for applications that require elasticity, resilience and tensile strength. As such, they occur in packaging as closures, valves and dosing systems. For example, the cap of a squeeze bottle may contain a silicone membrane that helps to properly dose the product. These silicone parts can disrupt the recycling process if they end up in the recycling stream. Generally speaking, elastomers cause various types of damage, such as imperfections and defects in the surface of products made from recycled plastic.

Silicones are also used as so-called slip additives in the packaging production process to alter the friction coefficient of the material and make it easier to process. In this case, they are not considered a packaging component, but as a processing aid used to produce and fill packaging.

Barriers, Fillers and Additives

Barriers, fillers and additives are substances added to the plastic to give the material certain properties. Examples of barriers include EVOH, SiOX, AlOX and evaporated aluminium (metallised). Examples of fillers include minerals (such as lime or talc, for barrier properties), fibres (e.g. from paper, grass or glass for reinforcement), mica (pearlescent effect for decoration), metal flakes (metallic effect for decoration) and iron oxide (terracotta colour for decoration).

Not all additives are plastics and their properties, such as their melting behaviour, may differ from those of plastics. These differences may complicate the recycling process, as the additive materials may clog the melt filters, for instance. Alternatively, they may affect the properties of the recycled material, making it less suitable as a raw material for new packaging or products.

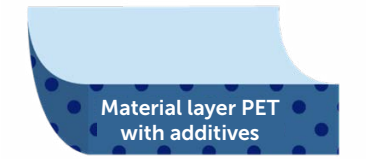
The impact of additives can differ from one main component to the next. Tests have shown, for instance, that PE and PP packaging with EVOH has optimal recyclability under certain conditions. With PET packaging, however, EVOH is not desirable because it causes discolouration of the recyclate.

These additives do not have a uniform effect on the quality of the recycled material.

How Barriers, Fillers and Additives Affect Density

All materials have a basic density. Plastics like PP and PE, for instance, float on water (density <1g/cm3), while plastics like PET, PS and PLA sink in water (density > 1g/cm3). Recyclers harness this convenient property in the separation process by making use of so-called sink-float separation tanks, which make it easy to separate PE and PET, for instance.

Adding gas to PET changes its density and may cause the PET to float, disrupting the sink-float process. The foamed PET will end up in the wrong stream and contaminate the PE stream. Adding large quantities of talc or lime to PE and PP can increase the density of these materials, causing them to sink and contaminate the PET stream.



Coatings

A coating is usually a thin layer of a few nanometres (nm=10-9 m) and is made of a different material than the main component. The coating is so thin and usually applied in such a way that separation of both types of material is impossible. Coatings are applied, for example, as seal medium on trays to attach cover film. In the recycling, coatings may lead to colour deviation or form small crystals in the recycled plastic.

TEST
protocol in development

We are still working on a protocol for assessing the extent to which barriers, fillers and additives affect recyclability.For the latest status, please check the KIDV-website.

Colour

Plastic packaging to which no dyes have been added is more widely applicable after recycling than coloured plastic packaging. Colourless, transparent packaging can be reworked into new transparent packaging. White packaging can be made into new, brightly coloured packaging after it is recycled. Colourless materials can therefore usually complete several recycling cycles and can be used for new packaging.

The main component can be coloured by mixing a dye into the material or by using coatings or inks to decorate the exterior. These colours can affect the sortability and recyclability of packaging.

Coloured PET, PE or PP

When coloured plastics are mixed with uncoloured plastics, discolouration occurs. Once it has been discoloured, material cannot be made colourless or transparent with common mechanical recycling techniques. This limits the possible applications of the material.

An exception is made for extremely light-blue PET bottles, which are primarily used for water. These can be recycled alongside colourless transparent PET. Since the amendment of the Packaging Management Decree (1 July 2021, only available in Dutch), these bottles fall under the deposit obligation and have been virtually eliminated from the household waste stream.

PE and PP are also increasingly sorted by colour during recycling. Coloured materials are still used and sold on a large scale, which is why no distinction is made in terms of the recyclability of coloured and coloured material - in contrast to PET.

Opaque PET

Light cannot pass through opaque PET. It is often died white with, for example, titanium oxide, calcium oxide, calcium carbonate or tin oxide. In large quantities, these dyes can interfere with recycling.

Opaque PET is not commonly used in the Netherlands, but in France, it is widely used for light-sensitive products such as dairy. The dyes cause cloudiness and discolouration in the rPET, so transparent PET is preferable. In France, opaque PET is sorted separately and recycled separately because this type of packaging is more common there.

CPET

CPET is a crystalline PET (composed of crystals) that is widely used for microwaveable packaging. CPET has a higher crystallinity than APET (amorphous, regular PET), which causes clouding and discoloration of the rPET, thus limiting the potential applications of recycled CPET.

Black Packaging

The most commonly used sorting technique uses Near Infra Red (NIR) cameras, as the spectrum of reflected infrared light can be used to identify different types of plastic. Black packaging does not reflect infrared light but absorbs, meaning the reflected light cannot be 'read' by the NIR scanner. The sorting system can therefore not detect the packaging and identify the type of plastic used, which means it cannot be sorted. This is especially true if the material used for the main component is fully coloured, but black print or large black labels or sleeves also increase the likelihood of sorting errors. Small black lids or caps do not affect detection because NIR systems scan the main component of a unit of packaging.

Carbon black (soot) is a common and inexpensive dye used for black and dark packaging, but it cannot be detected by NIR scanners. Some black dyes have a lesser impact on sortability, but the chance of sorting errors is still very high.

TIP

One of the key advantages of black packaging is that it can easily incorporate recycled content, as the original colour of the recycled material is no longer as relevant. However, black packaging is less likely to be sorted and recycled properly after the next cycle. Non-black packaging is much more likely to be sorted properly and therefore more likely to be recycled. If it is absolutely necessary to make the packaging black, be sure to use as much recycled material as possible.

Future Developments

New methods are being developed for sorting black plastics that can detect the black packaging but cannot yet sort it by material. Since the type of plastic cannot be identified, this type of packaging ends up in the mixed stream.

In the future, colour-sorting will become more common. There are already interesting examples of manufacturers separately sorting packaging with a very specific colour in order to turn it into new packaging in virtually the same colour.

5. Labels, Sleeves and Direct Printing

If a disposable unit does not feature any labels, sleeves or direct printing, they will not impact the recycling process and enhance overall recyclability.

Labels or sleeves may affect the recycling process. First of all, the size of the label or sleeve impacts the sortability of the packaging. If they cover all or most of the material that makes up the disposable unit for instance, it becomes more difficult to properly identify the material of the main component. Depending on the material used for the label or sleeve, the sorter may not sort the disposable unit with the correct material stream, which means it may not end up with the right recycler.

The material of the label or sleeve also impacts recyclability once the packaging reaches the recycler, as certain combinations of main components and labels or sleeves are easier, or more difficult, to separate than others.

Not all materials that end up in the wrong stream have the same impact on recycling quality. Paper labels, for instance, severely hamper the plastic recycling process and must be avoided as much as possible. The same goes for inks used for direct printing, as co-recycling these inks can severely impact the quality of the recycled material.

The Recycle Check guides users through a step-by-step process to determine the impact of labels, sleeves or direct printing on sorting and recycling.

Size, Labels and Sleeves

The size and material type of labels or sleeves affect the sortability of the main component. NIR cameras can easily detect packaging if the label or sleeve is not too big. If the label/sleeve is too large and made of a different material than the main component, the sorting machines will not be able to identify the material of the main component, which may mean that the packaging is sorted into the wrong material stream.

The figure below shows what percentage of the main component may be covered by a label or sleeve, depending on the size of the main component.

If the main component of the packaging and the label/ sleeve are made from different materials, the following rules apply with regard to the size of the label or sleeve relative to the main component:

- If the volume of the packaging is smaller than 500 ml, the label or sleeve may not cover more than 50% of the surface.
- If the volume of the packaging is smaller than or equal to 500 ml, the label or sleeve may not cover more than 70% of the surface.

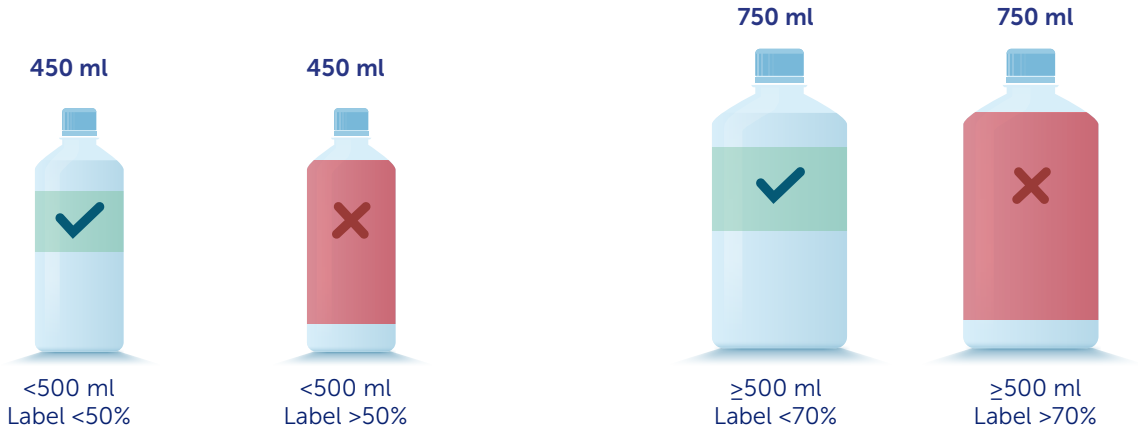


Figure 2
Size of the label relative to the bottle.

Figure 3
Look at the most fully covered side of the disposable unit.

TIP
The National Test Centre for Circular Plastics (Nationaal Testcentrum Circulaire Plastics, NTCP) has developed a handy tool to determine the size of labels and sleeves relative to the main component. When using the tool, always look at the side of the disposable unit that is most fully covered by the label or sleeve.
Click here to go to the tool (only available in Dutch).

When are oversized labels and sleeves still sortable?

If the Label or Sleeve is Made from the Same Material as the Main Component

In this case, the sub-component will be sorted into the same stream as the main component should be, which means both will reach the appropriate recycler.

If the Sleeve or Label Has to Be Removed to Reach the Product

If consumers have to completely remove the label or sleeve to use the product, it constitutes a separate disposable unit. In this case, the material will not interfere with the sortability of the main component.

If not, the consumer is unlikely to remove the label or sleeve. This makes the label/sleeve a sub-component that will interfere with sorting if oversized.

PETG, PE, PP and PS Labels and Sleeves

NTCP and the Fieldlab for Circular Plastics have extensively tested the sortability and recyclability of large labels and sleeves,with the results showing that oversized labels and sleeves do not interfere with sorting if they meet the following criteria:

- The sleeve is made of a mono-material
- The sleeve is no more than 120µm (0.12mm) thick
- The material does not contain carbon black
- The sleeve does not feature a light-impermeable layer
- The material has not been metallised

To what extent do labels, sleeves or direct printing affect recyclability?

The recyclability of highly sortable disposable units featuring labels, sleeves or direct printing depends on the following factors:

- It must be possible to separate the materials used in the labels or sleeves from the main component. The criteria for adhesives used to attach the labels or sleeves are disregarded at this point.
  See section 7 for more information.
- It has to be possible to co-recycle the materials used in the labels, sleeves or direct printing with the material used for the main component.
- If the labels or sleeves can be separated from the main component, this separated stream should preferably be processed separately into a new raw material.

As a general rule, the following materials should be avoided in rigid plastic packaging:

Non-Plastic Materials, Such as Paper and Aluminium

Non-plastic materials are undesirable in plastic packaging recycling because they do not melt during the recycling process. As a result, these materials may accumulate and block the sorting filters and paper fibres, for instance, may burn. It is often difficult to remove all materials. Paper fibres, for instance, tend to stick to plastic and get sucked into the plastic recycling process.

Non-fiber lost papers also interferes with the recycling process as it can sometimes contain the disruptor Bisphenol.

If the paper or aluminium can be removed, the secondary stream (sub-component materials consisting mainly of polyolefins) is not suitable for further processing.

PVC Sleeves

Sleeves, including full-body sleeves, are often made of PVC. PVC is considered a disruptor in the plastics recycling process.

The specific effects of labels, sleeves and printing on recyclability by main component type:

PET packaging with....

Labels/Sleeves Made of PE/PP

PE and PP labels or sleeves (with a density<1g/cm^3) are preferable on main components made of PET because they can be easily separated in sink-float tanks. PET will sink, while PE and PP will float.

The labels and sleeves removed from the main component can be processed into new raw materials as a polyolefin blend (PO blend of PE and PP).

Labels and sleeves made of other plastics, such as PETG, PS and PE/PP with a density >1g/cm3, are more difficult to separate from the PET in sink-float tanks. While recyclers can also turn to other methods to separate these materials from the rigid PET, there remains a risk of inks and non-PET materials interfering with the recycling process. These labels and sleeves cannot be processed as a secondary stream because these sub-components consist mainly of polyolefins.

Non-fiber lost paper is also unsuitable for processing as a secondary stream.

Foamed Labels

Foaming a plastic, i.e. injecting gas bubbles into the material to alter its texture, will change its density and may affect the sink-float process, as foamed PET is easier to separate from the PET used in the main component. Foamed labels do potentially reduce the processability of the secondary stream.

Direct Printing

Direct printing on PET packaging introduces inks into the recycling process which can cause discolouration of any transparent material. An exception is made for the direct printing of a best-before or use-by date (THT or TGT in Dutch), provided that this date is printed directly onto the PET, i.e. not on a printed background.

PE/PP packaging with....

PP and PE Labels and Sleeves

In the PP and PE stream, labels made of the same material as the main component pose no problem. Recyclers will, however, separate labels and sleeves from the main component where possible to keep the main component stream as pure and ink-free as possible. The stream of PE and PP labels and sleeves is also suitable for further processing.

PE disposable units with PP labels, or vice versa, do not interfere with the PE and PP recycling process. In PE and PP recycling, a small amount of PE or PP used for labels can be co-processed. These materials are primarily processed as a coloured stream. This means that inks have a smaller impact on the recycling quality than during PET recycling. For more information, see the tip on inks.

In-Mould Labels

In-mould labels are applied to packaging by means of an injection mould to eliminate the need for adhesives. This process is most commonly used for PP labels on PP packaging resulting in printed packaging made entirely from PP. For In-mould labels, the use of inks should be kept to a minimum and dark and black colours should be avoided.

Direct Printing

Direct printing has a moderate impact on the recyclability of the coloured stream of rigid PE and PP packaging.

Foamed Labels

Foaming a plastic, i.e. injecting gas bubbles into the material to alter its texture, will change its density and may affect the sink-float process by making it more difficult to separate the foamed PET from the PE or PP main component.

PETG Sleeves

Many PET sleeves are made from PETG. Tests have shown that disposable units made of this material, regardless of size, are easy to sort. Like regular PET (PETA), PETG is very dense and therefore easy to sort from the main component. It does, however, reduce the processability of the stream - which is not the recycler's target material for the recycler but can be processed by another recycler.

Other Plastics, Including PS and PLA

When the various materials are separated, materials with densities greater than >1g/cm3 sink, making it easy to separate them from main components made of PE or PP.

These materials are less desirable than PETG, however, because any remaining traces of the polymer in the main component may adversely affect the chemical composition of the recyclate.

Moreover, these materials reduce the processability of the stream - which is not the recycler's target material for the recycler but can be processed by another recycler.

Future - Innovation

Raw materials used in sub-components such as labels and sleeves are increasingly being factored into packaging recyclability assessments. The focus is shifting from removing undesirable materials in order to keep the main component stream as pure as possible to making sub-components from materials that can be recycled as a secondary stream.

Adhesives and inks are also playing a role of increasing importance in this process, as our understanding of the impact of adhesives and inks on recycling continues to grow.

For more information on adhesives, go to section 7.

TIP on using inks on labels and sleeves or for direct printing

- Use as little ink as possible.
- Ensure that the inks can be separated from the material that makes up the main component with the labels and sleeves. Inks that dissolve in the wash water can precipitate on the target material during drying, which can cause discolouration.
- Use inks that comply with EuPIA guidelines.*
- It is better to use Laser Coding to directly apply information to the main component.

*Inkts that comply with EuPIA guidelines ensure that fewer harmful substances enter the residual stream after de-inking. The EuPIA guidelines give no indication as to how easy it is to separate inks from other materials.

For more information, check out the KIDV fact sheet for inks - printing on packaging

6. Closures and Other Components

Is the packaging free from closures and other components?

Much like for labels and sleeves, lids, films and dosing pumps cannot impact recyclability if they are not present.

Packaging with Closures or Other Components

If the packaging does contain such sub-components, it is important to assess the extent to which they can be co-recycled with the material used for the main component. If they cannot be co-recycled, it is important to assess whether the main component can be separated from any sub-components to prevent the latter from interfering with the recycling process.

Whether or not the material used for sub-components is suitable for further processing also impacts the overall recyclability of the disposable unit.

General Impact

Enclosed Metal Parts

Metal components, such as springs and balls in soap dispensers and trigger sprays, hinder the recycling process if they end up in the plastic stream after sorting. Other metal components, such as RFID chips (Radio Frequency Identification) also hinder recycling.

There are various reasons that metals cannot be separated, such as their non-magnetic properties, for instance, because they are enclosed in or attached to the packaging or because they are so small relative to the packaging as a whole that they cannot be sorted into the metal stream using a magnet or eddy currents and end up in the mono-stream of PET, PE or PP instead. When that happens, the metal disrupts the shredding process and the further processing of the packaging by the recycler.

Non-Plastic Materials

There are many examples of non-plastic materials used in closures and other components attached to the disposable unit:

- Materials such as wood, which is sometimes used as a decorative cap
- Paper or cardboard used for an information card in a blister
- Aluminium used in seals for bottles and containers

All these materials are undesirable in the plastic recycling process either because they do not melt and therefore accumulate in the sorting filters, or because they may burn (paper) and negatively affect the quality of the recyclate. It is often difficult to remove all materials. Paper fibres, for instance, tend to stick to plastic, while parts of aluminium seals may also stick to the adhesive used on the main component and get sucked into the recycling process.

Wood, aluminium and paper or cardboard that can be removed will still reduce the processability of the secondary stream.

Closures Containing Disruptors Such as PVC and PVdC

The PVC (polyvinyl chloride) and PVdC (polyvinylidene chloride) used in packaging material disrupts the recycling of other plastics. If PVC ends up in the recycling stream of other plastics, e.g. as part of a component, it will trigger an unwanted chemical reaction that produces hydrochloric acid, which may damage the recycling equipment. The same applies to PVdC, which is mainly used as a barrier in films.

PVC is widely used in (imported) products and in transparent plastic boxes. It is also widely used as tamper evidence on closures, in blisters or as a sleeve around rigid packaging. PVC in applications other than packaging, also known as vinyl, is easily recyclable when processed as a separate stream. PVC recyclate is widely used and features in PVC sewage pipes, for instance.

Closures Containing Disruptors Such as Silicones and/or Elastomers

Elastomers such as silicones, acrylates and other rubber-like plastics are used for applications that require elasticity, resilience and tensile strength. As such, they occur in packaging as closures, valves and dosing systems. For example, the cap of a squeeze bottle may contain a silicone membrane that helps to properly dose the product. These silicone parts can disrupt the recycling process if they end up in the recycling stream. Generally speaking, elastomers cause various types of damage, such as imperfections and defects in the surface of products made from recycled plastic.

PET packaging with...

PE and/or PP-Based Material with Density <1 g/cm³

These sub-components are made of materials other than the rigid PET of the main component. They must be separated from the main component during the sorting and recycling process. This is easiest for sub-components made from PP or PE. When the separated sub-components are collected, they become a secondary stream. PET recyclers can still trade secondary PP and PE streams relatively easily.

Other Plastics or PE and/or PP with Density >1 g/cm³

Materials with a density of >1g/cm³ are more difficult to separate from PET. While recyclers can also turn to other methods to separate these materials from the rigid PET, there remains a risk of inks and non-PET materials interfering with the recycling process. These other materials are not suitable for further processing by the recycler, as the secondary stream does not contain their target material.

PET Flip-Top Lids

Flip-top lids made of PET are not permanently attached to the main component of packaging. It is very likely that the lids will be separated from the main component during collection and sorting. In this case, a flip-top lid behaves a disposable unit and must be assessed as such. This means that if it features printing, the printing ink will cause discolouration in the colourless transparent PET.

PE or PP packaging with...

PE and/or PP-Based Material with Density <1 g/cm³

PE and PP can easily be co-processed in recycling machines. PE closures and components featured on PE packaging are allowed in the PP recycling process to a limited extent. The case of PP closures and components featured on PE packaging is a bit more sensitive and special processes are in place to prevent large quantities of PP from entering the PE stream.

Other Plastics, Such as PET, PS, PC or PE and/or PP with Density >1 g/cm³

Several process steps of the recycling process for rigid PE and PP packaging are designed to separate sub-components such as caps, pumps and cover films from the main component. The materials in this category have a different density than the PE and PP, making them easy to separate. However, the resulting secondary stream is difficult to process.

Future - Innovation

Raw materials used in sub-components are increasingly being factored into packaging recyclability assessments. The focus is shifting from removing undesirable materials in order to keep the main component stream as pure as possible to making sub-components from materials that can be recycled in a separate secondary stream.

Adhesives are also of increasing importance in this process, as our understanding of the impact of adhesives and inks on recycling continues to grow. For more information on adhesives, see section 7.

7. Adhesives

Is the packaging free from any adhesives used for labels, sleeves or other components?

Disposable units without any adhesives are optimally recyclable.

Impact of Adhesives on Recycling

If adhesives are used to attach labels, sleeves or other components, the extent to which these adhesives affect the recyclability of the main component must be considered:

- Adhesives determine whether labels, sleeves or other components will detach from the main component during the recycling process.
- If the sub-components detach, it is important that the adhesive is disposed of with the water or with the sub-components.
- If the sub-components can be co-recycled or recycled separately, it is important that the adhesive used has no impact on recycling quality.

Little is still known about the impact of adhesives on the recyclability of different materials, so any claims on recyclability have to be demonstrated through testing.

TEST
Adhesives used for sub-components such as labels, sleeves and closures

Adhesives that do not meet the following criteria will be classified as 'moderately recyclable' by default.

Step 1 Based on the specifications, determine which adhesives have been used to attach labels, sleeves and other components.

Step 2 Check with Recyclass or your label supplier as to whether the adhesives used for your material have been approved under the relevant protocol.

Step 3 If not, have the adhesives and material tested . For an overview of available protocols, see the KIDV website.

Step 4 If the test result is positive, change the answer to this question to 'optimally recyclable' on the checklist.

Hot Washable Adhesives at main components of PET

To recycle PET packaging, it is shredded into flakes after sorting. The flakes are washed, partly to strip them of labels, tags and glue. For PET packaging, this is done with hot water. Sometimes detergents, such as alkali, are also used. Due to the friction created during shredding and washing, hot water gets between the main component and the label, causing the glue to come off. Adhesives do not interfere with the PET recycling process if they are dissolved using hot water (between 60-80°C) or alkali. This also applies to so-called hot melts which dissolve and/or release with alkali at up to 80°C. They are easily removed in a conventional washing process.

The European PET Bottle Platform (EPBP) has established protocols to test the releasability of hot washable adhesives for PET packaging.

Adhesives that do not release in the washing process can interfere with further recycling and should be avoided. One example are thermosetting hot melts, such as reactive polyurethane hot melts.

Another example are non-releasable pressure-sensitive adhesives. These are adhesives that form a bond by applying pressure to activate the adhesive, without the use of any solvent, water or heat.

Hot and Cold Washable Adhesives at main components of PE/PP

To recycle PE or PP packaging, they are shredded into flakes after sorting. The flakes are washed, partly to rid them of labels, tags and glue. For PE and PP packaging, this is done with cold water in some cases and hot water in others. Sometimes detergents, such as alkali, are also used. Due to the friction created during shredding and washing, the water gets between the main component and the label, loosening the glue.

There are a number of recyclers in the Netherlands that do hot wash PE and PP packaging. These recyclers process most of the Dutch household packaging.
However, cold washing processes are still widely used in the recycling of PE and PP packaging. A cold washing protocol has been drawn up for these washing processes in collaboration with Recyclass, NTCP and the KIDV.

In addition to the cold-wash protocol, a hot-wash protocol is also being developed, to test the extent to which hot-wash adhesives are processable in the hot-wash pods of PE and PP recyclers. Both protocols are under development at the time of publication of this recycle check.

Besides processability in the hot-wash process, the extent to which these adhesives have an impact on the recyclability of packaging that is cold-washed will also have to be tested. Of course, this also has a lot to do with the material combination of the main component and that of the sub-components assessed in the previous sections. Follow the latest status of the protocols here.

Adhesives that do not release in the washing process can interfere with further recycling and should be avoided. One example are thermosetting hotmelts, such as reactive polyurethane hotmelts. Another example are non-releasable pressure-sensitive adhesives. These are adhesives that form a bond by applying pressure to activate the adhesive, without the use of any solvent, water or heat.

Future - Innovation

Adhesives are used to bond main components and sub-components together as is necessary, while also allowing users to easily separate the various components.

Sustainable Packaging Options Other than making the packaging (more) recyclable

Tips for Sustainable Packaging

KIDV has drawn up seven tips that address the focus areas for more sustainable packaging practices. There is more to sustainable packaging than recyclability alone, as evidenced by tip 4 about using recycled content. If you do so in a packaging that has good recyclability, you contribute to the closing of the chain. When developing packaging, it is best to carefully consider all seven tips and make sure to meet the Essential Requirements.

Tip 5 also mentions renewable raw materials, such as bio-based plastics. These can be a sound alternative if using recycled content is not possible for food safety reasons, for instance. See the KIDV fact sheet for Biobased plastic packaging for more information.

How do you make sure that your packaging actually ends up with a recycler? Look no further than tip 7. In addition to designing the packaging to be recyclable, it is important that users of the packaged product properly dispose of the empty packaging after use. You can use the Disposal Guide to inform consumers about the correct way to dispose of packaging.

Sustainable Packaging Compass

KIDV has launched a Sustainable Packaging Compass, which consists of three modules that measure the recyclability, circularity and environmental impact of packaging. The modules are complementary.

With this insight, companies can compare different units of packaging and types of packaging, assessing their scores on various aspects of sustainability.

This helps them define targets for making packaging more sustainable and measure the effects of their packaging optimisation efforts. The tool can be used free of charge via this link.

Courses

Are you looking to kick-start your efforts towards greening your packaging portfolio, packaging or strategy? Have you already started but need new insights? KIDV offers training programmes that provide theoretical and practical insight into the world of sustainable packaging. This programme is based around KIDV's knowledge and tools, such as KIDV's Five perspectives on sustainable packaging® model and the Recycle Checks. The programme is complemented by relevant current themes and practical examples. You can use the acquired knowledge and skills to help you formulate a strategy to make your packaging more sustainable and to apply our practical tools in your own professional practice. For more information, click here.

The State of Sustainable Packaging

This publication takes a strategic look at the partnerships and innovations we will need in the field of sustainable packaging in the short, medium and long term. The State of Sustainable Packaging offers a strategic perspective on the necessary collaboration and innovations with regard to sustainable packaging. The publication identifies the social and economic hurdles that stand in the way of sustainable packaging. To tackle these hurdles, KIDV has developed a strategy with three innovation tracks that offer short-, medium- and long-term effects. These range from more and better recycling, which has already been achieved in some countries, to increased circularity and ultimately to intrinsic sustainability.

More Information

If you have questions about the Recycle Check or about making your packaging more sustainable, please contact KIDV.

Links to Protocols

For the latest status on available protocols, please go to
https://www.kidv.nl/protocols-recycle-check

Links to Relevant Documents

- KIDV Packaging Glossary

Diagram of Packaging Components

- Laws and regulations on packaging
  (only available in Dutch)

Checks and Guidelines from Other Countries:

- Recyclass
- Cyclos-HTP
- Citeo Cotrep
- EPBP
- FH campus Wien
- Fost Plus

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