



Kennisinstituut
Duurzaam Verpakken

Fewer bags, sustainable (re)use and good practice

'Reducing the environmental impact of (plastic) carrier bags in the retail
channel'

Summary and Conclusions

22 January 2015

Foreword

The Netherlands Institute for Sustainable Packaging (Kennisinstituut Duurzaam Verpakken — KIDV) has carried out research into how the environmental impact of (plastic) carrier bags in the retail channel can be reduced. This research was conducted in accordance with the brief from the Packaging Framework Agreement 2013-2022¹ and the Addendum to this framework agreement².

The study consisted of two parts: the pilot ‘Can’t we use fewer bags?’ and the materials study ‘DoorTASend’ (a pun: ‘Doortastend’ means resolute in Dutch and ‘tas’ means ‘bag’).

Pilot: ‘Can’t we use fewer bags?’

From 10 October until the end of December 2013, together with the Dutch Retail Council (Raad Nederlandse Detailhandel — RND), the KIDV conducted the pilot ‘Can’t we use fewer bags?’ The pilot investigated whether the pricing of plastic carrier bags can reduce the number of carrier bags given out in shops. It also examined whether the pricing of carrier bags influences the behaviour of consumers when shopping. The KIDV presented the results of this pilot on 4 February, 2014.

Materials study: ‘DoorTASend’

In 2014, the TNO (Dutch Institute for Applied Scientific Research) conducted a materials study for the KIDV to see which materials and shapes of carrier bags have the least environmental impact. This included a so-called ‘life cycle assessment’ (LCA) of the environmental impact of carrier bags.

To give some insight into the environmental impact and multiple reuse of the various carrier bags, following the standard LCA methodologies proved insufficient within ISO standards. In the absence of an ISO standard for a part of the research, TNO for that part made a considered decision to use a widely-used methodology. In addition, several sensitivity analyzes were carried out.

Litter could not be included in the LCA, since there is currently no generally accepted methodology available. But because the degradability of bags is an important factor when it comes to litter, this factor is made clear in the study for various the materials.

This report gives the summary and conclusions of both the pilot ‘Can’t we use fewer bags?’ and the ‘DoorTASend’ materials study performed by TNO. Thereby answering the project’s main question, namely “How can the environmental impact of (plastic) carrier bags in the retail channel be reduced?”

For the execution of the materials study, KIDV assembled an external committee consisting of a broad representation of experts from various industries and interest groups. This committee of experts had a reflective and advisory role from the perspective of the practical application of carrier bags and substantive knowledge of the materials. In addition, the KIDV also had a committee of LCA experts review the LCA. The KIDV Advisory Board also gave its input. The experts committee, review committee and Advisory Board have provided valuable input, resulting in modifications and improvements to the materials study at various stages. Following the final improvements on the

¹ Article 3 (5c).

² Paragraph 5.1

basis of the final findings of the review committee, further small modifications³ were made that changed the results a little but did not substantially alter the conclusions. The reports of both committees and of the Advisory Board are included as part of the TNO report.

We would like to thank all those who have contributed to the materials study, in particular the researchers at TNO, and the members of the expert and review committees. We also thank their membership for the information and insights they provided.

The Hague, January 2015
Hester Klein Lankhorst
Director, Netherlands Institute for Sustainable Packaging

³ Additional data were provided from the RISI database regarding paper prices, and a lower scenario regarding reuse was included.

Approach, assumptions, conclusions and key results

Approach

How can we arrive at a plan to reduce the environmental impact of (plastic) carrier bags in the retail channel? This principal question is central to the KIDV project 'Reducing the environmental impact of (plastic) carrier bags in the retail channel'.

Reducing the number of (plastic) carrier bags in the retail channel aims to prevent unnecessary waste of resources and reduce environmental impact. This can be studied in a logical manner using an approach consisting of the following four interrelated and sequential steps:

1. Reducing the number of carrier bags given out.
2. Stimulating the reuse of carrier bags.
3. Optimizing the range of carrier bags, by choosing carrier bags with the least environmental impact.
4. Stimulating the appropriate 'disposing behavior' at the end of the life of carrier bags.

Step	Activity and research
1	<p><i>Reducing the number of carrier bags given out.</i></p> <p>In the 'Can't we use fewer bags?' pilot the KIDV, together with the RND), investigated the effect of the pricing of plastic carrier bags on the number of carrier bags given out in shops, and on consumer behavior while shopping. The pilot was conducted from 10 October through to the end of December 2013.</p>
2	<p><i>Stimulating the reuse of carrier bags.</i></p> <p>Commissioned by KIDV, in the first half of 2014 TNO carried out the 'DoorTASend' materials study. This looked at the difference in the environmental impact of single-use and multiple-use carrier bags. By encouraging consumers to reuse carrier bags the outcomes of the 'Can't we use fewer bags?' pilot can also be utilized.</p>
3	<p><i>Optimizing the range of carrier bags, by choosing carrier bags with the least environmental impact.</i></p> <p>In the materials study, a life cycle assessment (LCA) was conducted into the environmental impact of carrier bags to determine which materials and shapes of carrier bags have the least environmental impact.</p>
4	<p><i>Stimulating the appropriate 'disposing behavior' at the end-of-life stage of carrier bags.</i></p> <p>In the materials study, the end-of-life phase of carrier bags is included in the LCA calculations. Carrier bags may end up as litter. Because there are no standard data available on the amount of carrier bags that end up within litter, it is impossible on the basis of the materials study to determine the quantitative contribution of litter to the end-of-life phase. However, as part of the materials study, a literature scan was carried out with respect to the degradability into the environment of the various materials. Furthermore, on the basis of activities of the KIDV regarding the Weggooiwijzer (Disposer Guide) and Meldpunt Verpakkingen (Packaging Helpdesk) action strategies can be offered to stimulate appropriate disposing behaviour by consumers.</p>

KIDV commissioned the research project 'Reducing the environmental impact of (plastic) carrier bags in the retail channel' to generate knowledge. Businesses/retailers⁴, consumers and government policymakers can use this knowledge when implementing the four steps described above.

Starting points

The purpose of the study is to provide insight into and information on the environmental impact of various materials for three types of carrier bags. In order to do this, given the data available, the following choices were made in terms of the chosen methodology, litter, reuse, scope of the research and data availability:

Methodology

In the 'DoorTASTend' materials study use is made of the guidelines in ISO 145040/14044⁵ and of the ILCD handbook (International reference Life Cycle Data system) when carrying out the LCA study. In it, the environmental impact of the various carrier bags is compared per effect category.

Shadow costs methodology

In the study a weighted comparison and aggregation of the different environmental themes is made. The ISO standards do not provide for the application of standards and aggregation. Therefore the contributions of the different impact categories were weighted and added up into one overall score, namely the overall environmental impact of a carrier bag on the complete lifecycle based on the so-called 'shadow costs method'.

Using this method, the impact of the various environmental impact categories are weighted and added up to a total score per carrier bag. These shadow prices are expressed in Euros as a weighting factor for the environmental impact. The shadow prices are thus not the actual cost in Euros. They function as indications of the value the current Dutch society assigns to the avoidance of environmental impact.

The use of shadow prices is neither in accordance with ISO standards for LCA nor the ILCD handbook. Nevertheless the use of shadow prices is necessary to be able to evaluate the total of the many types of environmental effects of the tested materials. Though this methodology does not fall within the ISO guidelines, it is commonly used and among others applied in the pilot 'Inzamelen en hergebruik drankenkartons' (Collection and reuse of drinks cartons) by the KIDV.

Litter

Within the framework of the 'Reducing the environmental impact of (plastic) carrier bags in the retail channel' project, no conclusions can be drawn regarding the proportion — or environmental impact — of plastic carrier bags within litter. This is because there are no data available on the quantities of plastic carrier bags within litter in the Netherlands. Also, there is no method available to comprehensively weight the environmental impact of litter.

⁴ This refers to all retailers.

⁵ ISO 14044: 2006 Section 4.4.5 LCIA intended to be used in comparative assertions intended to be disclosed to the public.

When litter is a critical factor in deciding how to optimise the assortment of carrier bags, then a material will have to be assessed separately on its effect on litter and on its environmental impact. The degradability of the material is important here.

Reuse

In the materials study, the potential of reuse of carrier bags is depicted using a scenario based on professional judgment. This was done because at the time the study was executed, there were no data available on the technical and economic longevity of carrier bags.

Researched materials and carrier bags

In the materials study twelve different materials for three types of carrier bags were studied. In total 20 different carrier bags were compared. In practice, there is even a larger number of variants and sizes of bags available.

Data availability

An LCA is always carried out at a certain moment in time. Whereby data and process-data are used which are then currently available and usable. Processes are continuously updated and improved, and for some of the materials studied, current data are limited.

Review committee

A committee of LCA experts has reviewed the TNO report summarized in this KIDV report. The findings of the review committee regarding the TNO report therefore also apply to this KIDV report. It is important to mention here that ISO 14040/14044 does not allow weighting of environmental indicators in comparative studies (something that is done in this KIDV report). Moreover, the environmental impact of litter is important, but there is as yet no suitable LCA indicator for it (and it is therefore not included in the weighted results, and thus also not in the shadow costs). The full findings of the review committee regarding the TNO report are included as appendices in the TNO report.

KIDV explanatory note

It is important to mention that the aggregation of environmental issues is neither in accordance with ISO standards for LCA nor the ILCD handbook. Applying one aggregated environmental score (a total score in the form of the shadow price methodology) therefore doesn't meet the ISO and ILCD standards, but is necessary in order to evaluate the total of the many types of environmental impact of the materials studied. Though this methodology does not fall within the ISO guidelines, it is commonly used and among others applied in the pilot 'Inzamelen en hergebruik drankenkartons' [Collection and reuse of drinks cartons], carried out by the KIDV.

Conclusions

The conclusions that can be drawn on the basis of the pilot 'Can't we use fewer bags?' and the 'DoorTASend' materials study are stated below, described per step of the followed approach.

Step 1: Reducing the number of carrier bags given out.

The pilot 'Can't we use fewer bags?' proves that the number of carrier bags given out can be reduced through a combination of pricing and good communication with businesses, retailers and consumers. The results of the pilot show the following:

- With the use of pricing and communication, the number of carrier bags given out during the pilot period reduced per purchase: during the pilot reductions of 48 to 77 percent were reported.

- Participating companies were positive about the outcome of the pilot, as were residents of the pilot municipalities. Research amongst residents showed that 81 percent of respondents were positive about the pilot and 87 percent thought it would be a good thing if measures were taken to reduce the amount of bags.

Step 2: Stimulating the reuse of carrier bags.

The results of the materials study show that the environmental impact of reused carrier bags is lower than of single-use carrier bags. This applies to both mid-sized carrier bags and big shoppers. For singlet bags it is assumed that these are only used once.

In broad terms, it appears that the environmental impact of mid-sized carrier bags and big shoppers is lower with multiple use than single use.

- With single use, the shadow costs vary between 0.003 and 1.32 Euros.
- With multiple use, the shadow costs vary between 0.0002 and 0.044 Euros.

This difference shows that the multiple use of a carrier bag is important in reducing environmental impact.

As already mentioned, it appears from the pilot 'Can't we use fewer bags?' that pricing and good communication have a positive effect on reducing the number of bags given out in stores. During this pilot the message communicated to customers was to bring a bag themselves more frequently and to use a bag more often. It is clear that the use of targeted communication as part of this step and the previous steps, plays an important role in the further stimulation of multiple-use of carrier bags by consumers.

Step 3: Optimizing the range of carrier bags, by choosing carrier bags with the least environmental impact.

Types of carrier bags and materials

In this materials study it was decided to examine twelve different materials for three types of carrier bag. A total of 20 different carrier bags were compared. In daily practice, an even greater number of variants and sizes (dimensions and weight) of carrier bags are available. This study only provides insights into the results of the 20 variants examined.

This study takes into account the volume and weight of the purchases. In the study the moisture or the temperature of the purchases have not been taken into account. It is assumed that moist purchases are packaged in primary packaging and the carrier bags investigated in the study are not primary packaging, but a means for transporting purchases.

MATERIALS	BAG FORMATS		
	Singlet bag	Mid-sized bag	Big shopper
HDPE			
(r)-LDPE			
(r)-PP			
(r)-Paper			
Cotton			
PBAT/PLA blend			
Bio-PE			
Starch blends			
PET (Polyester)			
Jute			

Definition of material acronyms: High Density Polyethylene (HDPE), Recycled HDPE (r-HDPE), Low Density Polyethylene (LDPE), Recycled LDPE (R-LDPE), polypropylene (PP) Recycled PP (R-PP), Paper, Recycled Paper (r-Paper), Polylactic acid blend (PBAT / PLA blend), Bio Polyethylene (Bio-PE), PolyEthyleenTheraphtalaat (PET, Polyester).

Number of times reuse

In addition, a realistic scenario was drawn up⁶ to estimate the number of times carrier bags are reused. In this scenario it is assumed that mid-sized bags and big shoppers are suitable for reuse. It is assumed singlet bags are used only once (for transporting purchases).

General

The materials study shows that carrier bags made from recycled materials have a lower environmental impact than the primary version of the same material.

⁶ This is considered a realistic scenario whereby no research is carried out into the real or the most desirable consumer behavior. The estimate was made in consultation with the expert group. Among other factors, the technical longevity of the various materials was taken into consideration.

Materials for mid-sized carrier bags and big shoppers

The materials study shows that multiple use of the carrier bags delivers the following results:

- *Big shoppers* made of (r-) PP, polyester (PET) and jute have the lowest environmental impact. Big shoppers made of paper or cotton have the highest environmental impact.
- *Mid-sized carrier bags* made from polyester (PET), (r-)LDPE and r-Paper have the lowest environmental impact. The cotton and paper mid-sized carrier bag have the highest environmental impact.

Materials for singlet bags

As shown in step 2, reuse of carrier bags is important in reducing environmental impact. Based on the assumption that singlet bags can only be used once for carrying purchases, it is clear that including singlet bags in the assortment of carrier bags does not contribute to a further reduction in environmental impact.

In order to nevertheless be able to make a comparison, the different singlet bags are compared with each other in the materials study. On this basis it appears that:

- *singlet bags* made of HDPE, Bio-PE and starch blend have the lowest environmental impact;
- *singlet bags* made of r-Paper have the lowest environmental impact when the cut-off allocation methodology is applied⁷.

Step 4: Stimulating the appropriate 'disposing behavior' at the end-of-life phase of carrier bags.

To encourage consumers to dispose of (multiple-use and sustainable) carrier bags in the appropriate way, vehicles such as the 'Disposer Guide', the Recycle Manager and the 'Packaging Helpdesk' are used, again in combination with targeted communications, as a part of this and previous steps.

- The Disposer Guide helps producers/purchasers of packaging as well as consumers to dispose used packaging material appropriately. Icons on the packaging - or in this case the carrier bags - indicate to which category of waste the (various parts of) a packaging belong. So people can see at-a-glance how packaging should be disposed of. The KIDV has drafted guidelines on the use of the Disposer Guide icons.
- The Recycle Manager gives consumers, via a website and an app, information about which (packaging) waste belongs in which bin.
- At the Packaging Helpdesk consumers can report on - and ask questions about - the sustainability of packaging. Reports from consumers via the Helpdesk Packaging are answered by companies. Consumers' questions are answered by Milieu Centraal (a Dutch information center for citizens on environmental issues) in consultation with the KIDV. Because the Helpdesk regularly gets questions from consumers about the disposing of packaging, these are also included in the FAQs and the Packaging Helpdesk's homepage also provides a link to the Recycle Manager.

In the context of the project 'Reducing the environmental impact of (plastic) carrier bags in the retail channel', no conclusions can be drawn yet regarding the proportion - or environmental impact - of plastic carrier bags within litter as a whole. No data are available on the amount of litter of plastic carrier bags in the environment in the Netherlands. There is currently no method available to comprehensively weigh the environmental impact of litter.

⁷ A method for allocation, whereby the life cycle is curtailed at a given point. All environmental impact that is caused further down the (recycling-)chain is allocated to the next product. This approach is applied when testing the methodologies used in the sensitivity analysis.

On the basis of a literature scan, the following conclusions can however be drawn regarding the degradability of various carrier bag materials:

- The biodegradability of materials depends on the presence and activity of the types of micro-organisms in the environment, which in turn depend on the physical surroundings.
- Cotton, jute and paper are broken down faster than fossil plastics. It has not been proved that plastics can be completely degraded.
- The degradability of biomass-based plastics depends on the composition of the plastic. If it is certified in accordance with the EN13432 standard for biodegradable plastics, this means the plastic is degradable in an industrial composting plant but not necessarily in nature.

Important results

Based on the above conclusions from the pilot 'Can't we use fewer bags?' and the 'DoorTASend' materials study, the following action opportunities can be formulated, for businesses and retailers on the one hand and consumers on the other. These action opportunities can also provide input for government policy makers.

Action opportunities for businesses and retailers

Minimalise the number of carrier bags given out.

- Decide to reduce the number of carrier bags given out. The pricing of carrier bags combined with good communication with staff and clients works: it leads to a significant decrease in the number of carrier bags given out per purchase.

Stimulate multiple use of carrier bags.

- Prevent single usage of carrier bags and offer multiple-use carrier bags made of sustainable materials as an alternative.
- Encourage clients to (always) bring their own carrier bag with them.
- Instead of asking 'Would you like a bag for that?' ask whether 'It's OK like that?' (i.e. without a separate bag).

Optimalise the assortment of carrier bags.

- Include multiple-use carrier bags in the assortment. Select big shoppers made of sustainable materials such as (r-)PP, PET (polyester) or jute and mid-sized carrier bags made of PET (polyester), r-(LDPE) or r-Paper.
- If singlet bags for single use do have to be available in the assortment for small purchases, then choose HDPE, Bio-PE, starch blend or r-Paper. These are the singlet bags with the least environmental impact.

When litter is a key issue in deciding how to optimise the assortment, then a material needs to be assessed separately for its effect on litter and the environmental impact of the material. The degradability of the material is also important. For the following materials an estimate has been made as to their degradability in a natural environment.

- Paper is estimated to break down rapidly on land, in soil (3 months) and in water (rapidly degradable).
- Jute and cotton are estimated to be broken down on land (0.5 years), in soil (degradable) and in water (degradable).

- Bio-based biodegradable material is estimated to degrade on land, in soil (> 2 years) and in water (slowly degradable).
- Bio-based, non-biodegradable (Bio-PE) is estimated to degrade very slowly on land, in soil and in water.
- Plastics are estimated to degrade very slowly or not at all on land, in the soil (> 35 years - infinity) and water (very slowly degradable). It is not proved that plastics can be completely degraded.

Action opportunities for government policy makers

Ensure consumers know how they should dispose of (sustainable and reusable) carrier bags at the end-of-life phase.

- Encourage the use of the Disposer Guide ([Weggooiwijzer](#)) and ensure the appropriate icons are used on the carrier bags issued.
- Steer consumers towards the Recycle Manager ([Recyclemanager](#)) if they have questions about the disposal of carrier bags and/or other packaging.
- Steer consumers towards the Packaging Helpdesk ([Meldpunt Verpakkingen](#)) if they have questions about the sustainability and/or the disposal of carrier bags and/or other packaging.

Action opportunities for consumers

Always take your own carrier bag(s) with you when you go shopping, and reuse the carrier bag(s) you have purchased more often.

- The more you reuse a carrier bag, the better it is for the environment.
- Always take your own carrier bag(s) from home when you go shopping to carry your purchases.
- In stores, don't accept (singlet) bags for single use only. If you do accept a singlet bag, use this later as, for example, a pedal bin liner.

Information on materials for carrier bags

If you buy a bag, choose a mid-sized or big shopper made from sustainable materials.

- When buying a bag choose a big shopper or medium-sized bag that you can reuse.
- If you decide to purchase a big shopper, choose one of the following materials:



- If you decide to purchase a mid-sized bag, choose one of the following materials:



- If you decide to purchase a singlet bag, choose one of the following materials:



Information about 'disposing' behavior of commonly used carrier bags

If your (durable and frequently used) carrier bag is broken and must be thrown away, do it in the appropriate way.

- Avoid your carrier bags ending up as litter.
- Dispose of your carrier bags appropriately: check on the bag in which bin it should be deposited. If in doubt, use the Recycle Manager or see the FAQs on the Packaging Helpdesk.

Information about the degradability of materials in litter

If carrier bags are thrown away in the wrong way, they end up on the street or in nature.

In which case, it is important to know the degradability of the materials in the environment:

Paper	Kraft paper	Quickly degradable
Textile	Jute, cotton	Degradable
Bio-based	Biodegradable	Slowly degradable
	Non-biodegradable	Very slowly degradable
Plastic	PET, PE, PP	Very slowly degradable