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Life Cycle Assessment of a Reusable Takeaway Container

Submitted in fulfillment of the requirements for the course:

"Creation of a Life Cycle Assessment Study Using LCA Software"

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Date Submitted: August 31, 2021

1. Introduction

The consumption of takeaway food has increased rapidly over the past years. Especially since the COVID-19 pandemic, it has been more popular than ever (Mahy, 2021). While takeaway food is a convenient option for many, there are some environmental concerns associated with it. Normal plastic takeaway containers are made only for a single use, adding 59% to the annual plastic trash in Germany (NABU, 2020). An attempt to fight plastic pollution is being made by the European Union and its 2019 directive on the "reduction of the impact of certain plastic products on the environment", which states that single-use plastic will be no longer allowed for sale unless there is no adequate, reusable alternative (Directive (EU) 2019/904). As a response to this directive and the underlying issue, an increasing number of start-ups has been founded over the last years, offering a simple solution: reusable takeaway containers (RTC) to borrow and return to the restaurant, in exchange for a small deposit. "Relevo", "Vytal" and "Rebowl", just to name a few, are some of the above-mentioned start-ups in Germany. While there is scientific literature about the concerns of single-use plastic containers, only few assess the full Life Cycle (LCA) of these (Gallego-Schmid et al., 2019). At the same time, while Life Cycles of reusable containers do exist, most of them focus on containers made from PP, PET or PT, often originating from countries like the US or China (e.g. Woods and Bakshi, 2014; Potting and van der Harst, 2015; Vercalsteren et al., 2010). The fact that many RTCs are made from these three materials makes those studies very meaningful. Nevertheless, a number of start-ups focuses on the use of alternative materials that are produced locally, which makes the conduction of a LCA about them necessary, too.

2. Goal of the Study

In a first step, this study aims at assessing the life cycle of RTCs made from styrene-acrylonitrile (SAN) with a Thermoplastic Elastomere (TPE) lid, which are manufactured and sold in Germany (*Fig. 1*). Since not only the demand for takeaway food, but also for a more sustainable future are on the rise, and since an increasing number of these kinds of relatively new start-ups are being established, it is important to be able to quantify the environmental impacts and benefits they offer.

Secondly, the environmental impact of RTCs made from SAN will be compared to the environmental impact of single-use containers (Aluminium takeaway container and Extruded polystyrene takeaway container) as well as a Polypropylene (PP) reusable food saver (Tupperware) from the EU. This step is designed to quantify the benefit of the use of RTCs

compared to single-use containers. Furthermore, it is supposed to demonstrate whether SAN holds any benefit compared to PP.

Fig. 1*: The container with lid to be analyzed.*

The intended study specifically refers to containers made from SAN paired with a TPE lid, which are manufactured, sold and used in Germany. The respective materials stem from the Netherlands and Germany. This study can be transferred to similar materials stemming from the EU and being distributed and used locally. However, it cannot be transferred to strongly differing materials with a different manufacturing processes, or transportation distances which are much longer.

The necessary data has been collected through collaboration with the manufacturer of the containers “Ornamin” as well as the start-up “Relevo”, which distributes the containers to partnering restaurants. This study is designed to address four groups: 1. Consumers who are on the lookout for a more sustainable alternative to takeaway food, 2. Restaurants that are hesitant about whether to collaborate with these kinds of start-ups and are also looking for a more sustainable option, 3. Arising start-ups which are unsure about which kind of material for the containers to choose (e.g. SAN vs. PP), and 4. Producers who want to know which part(s) of the production process are the most (least) impactful and yet to be improved.

3. Scope Definition

The product system to be studied is the production, distribution, packaging, usage and end of life of a 670ml bowl (SAN) with lid (TPE) from Ornamin. The Functional Unit (FU) is the production, use and disposal of a container storing a meal for one person (670ml).

The impact categories to be considered are abiotic depletion potential of elements (ADPe.), abiotic depletion potential of fossil resources (ADPf.), acidification potential (AP), eutrophication potential (EP), global warming potential (GWP), human toxicity potential (HTP), marine aquatic ecotoxicity poten- tial (MAETP), freshwater aquatic ecotoxicity

potential (FAETP), ozone depletion potential (ODP), photochemical oxidants creation potential (POCP) and the terrestrial ecotoxicity potential (TETP). The container size, FU and impact categories are identical with the ones from the LCA to be compared, in order to assure a proper comparison (Gallego-Schmid et al, 2019). The LCI data is mainly primary data from the providers to reach a high representativeness. Some background data from the LCA software has been used, too. For a high representativeness of the background data, comparisons with other literature have been made.

The LCA software used is OpenLCA 1.10.3 with the Ecoinvent 3.5 database. The LCA is done in accordance with the official guidelines on LCAs ISO14040 and ISO14044. The default "Allocation at the Point of Substitution" setting has been chosen, meaning that it follows the attributional approach (source: Ecoinvent). The LCIA model "CML-IA baseline" has been chosen in accordance with the comparing study. The system boundaries of the study are shown in Fig. 2. The following items are included:

- Raw Materials:
  - Styrene-Acrylonitrile Copolymer (SAN, for the container)
  - Acrylonitrile-Butadiene-Styrene Copolymer (ABSC; similar to TPE, for the lid)
  - Cardboard and paper for packaging
- Production:
  - Injection molding (container and lid)
- Transport:
  - Raw materials to production site (materials for container and lid separately)
  - Containers with lid to start-up location (distributor)
  - Distribution to restaurants
  - Used containers back to production site for recycling
- Use:
  - Washing with industrial dishwasher
- End of Life:
  - On-site recycling of the containers
  - Disposal of packaging materials

For the lid, ABSC was used instead of TPE, since the Ecoinvent database did not contain the raw material TPE. Therefore, literature using the same database was successfully searched for possible materials representing TPE (Johansson, 2018). Furthermore, the database did not contain the recycling process of SAN and TPE, wherefore a similar material (Polyethylene Terephthalate) was taken into account. The transport of the individual consumer to and from the restaurant to pick up and return the RTC is not considered. This corresponds with the study

of comparison (Gallego-Schmid et al, 2019). Lastly, no data for the use of industrial dishwashers was given, for which reason the same inputs and amounts as in the comparative study were taken into account. These are: electricity, water, soap, salt and rinsing agent (Gallego-Schmid et al., 2019). The foreground system consists solely of data from the manufacturer, since it was the main source of data (Fig. 2). While the process "Packaging" appears in the system boundary, it is not taken into consideration in the life cycle inventory data sheet (Tab. 1), since it is done by hand and therefore not further relevant for the assessment of environmental impacts.

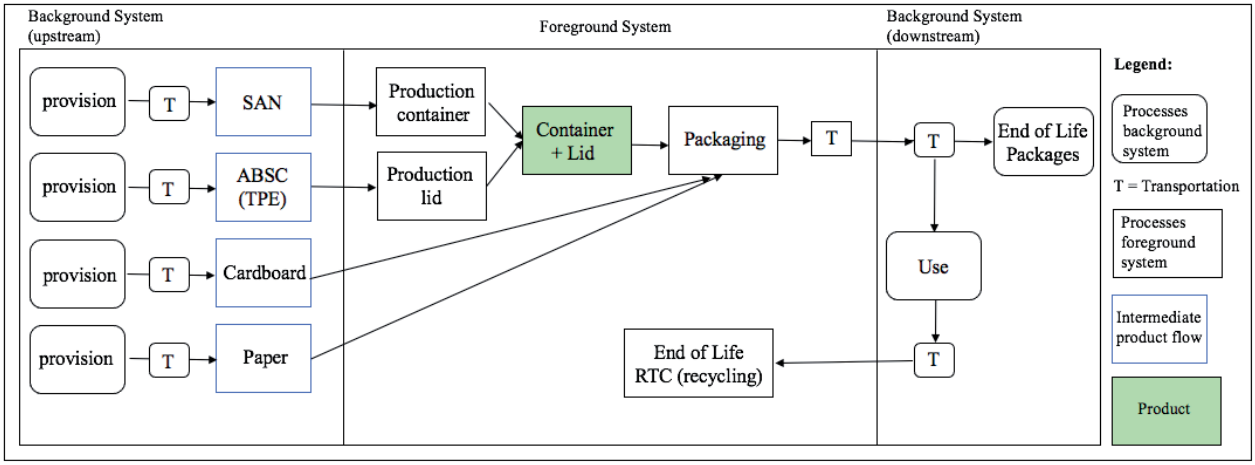

***Fig. 2**: System Boundary for the container with lid.*

4. Life Cycle Inventory Analysis

The following life cycle stages have been considered in this study: Raw Materials, Transport, Production, Use and End of life (see *Tab. 1*).

The raw materials are SAN (called "styrene-acrylonitrile copolymer" in the Ecoinvent database) for the container and TPE (called "acrylonitrile-butadiene-styrene copolymer" in Ecoinvent) for the lid. They both refer to Europe, and the quantities for each are given by the producer. The SAN is supplied from Hoek, The Netherlands, and the TPE is supplied from Wesel, Germany. The packaging materials paper and cardboard are available in the Ecoinvent database as "paper, woodfree, uncoated" and "corrugated board box". For both, the market for Europe has been selected, as it also includes the average transport from the paper/board box factory to the using end (in this case, the RTC production site). The amounts are again provided by the producer.

There are four types of transport included in this study:

1. The transport of the raw materials to the production site, which consists of 368 km for the SAN and 213km for the TPE, both with a 40t truck.
2. Transport of the finished product from production site (Minden, Germany) to the start-up (Munich, Germany), resulting in a distance of 638 km with a 40t truck.
3. Transport of the RTC from the start-up location to partnering restaurants. Primary data was obtained and a mean distance of 346.3 km calculated. The chosen vehicle is a 12t truck, which is an estimated value based on official information from DHL.
4. Transporting the used RTC back to the initial production site (Minden), where the materials are 100% recycled in-house. All necessary information about the distances and almost all information about the trucks were provided by the producer and start-up, which is why it has quite a high certainty. The EURO6 emission standards are considered here.

Life Cycle Stage	**Material Name**	**Value&Unit**	**Source**
Raw Materials	SAN	121.5g	internal
	TPE	49.59g	
Raw Materials (packaging)	Paper	56.25g	internal
	Cardboard	12.1544g	
Transport	Raw Materials: Transport to production site with lorry, 40t	55.27467kg*km	internal
	Finished container with lid: Transport to start-up location with lorry, 40t	152.79743kg*km	
	Finished container with lid: Distribution to partnering restaurants with lorry, 12t	82.93691kg*km	from start-up
	Used container with lid: Transport back to prduction site for recycling with lorry, 40t	152.79743kg*km	internal
Production	Container Injection molding: Electricity	0.37906MJ	Background data
	Lid Injection molding: Electricity	0.15471MJ	
Use (machine dishwashing)	Electricity	57.5J	Comparative study (Gallego-Schmid et al, 2019)
	Soap	0.2g	
	Salt	0.2g	
	Rinsing agent	0.03g	
	Tap water	0.2L	
End of Life	Recycling SAN	121.5g	internal
	Recycling TPE	49.59g	
	Paper, recycling	56.25g	Background data
	Cardboard, recycling	12.1544g	

Tab. 1*: Life cycle inventory data for all life cycle stages.*

For the production, the method of injection molding is used for both the container and lid. Here, the given values from the producer and the process in the Ecoinvent database could not be matched well, which is why the default values for the injection molding of 121.5+49.59g of material are being used. This might lead to slightly different outcomes, for which reason this step is to be seen as an exemplary one in the first part of the study, and it will not be emphasized much in the second comparison part.

Since no representative primary data for the use of the RTCs was available, the same values as for the reusable containers of the comparative study have been taken on. These include electricity, soap, salt ("sodium chloride, powder"), rinsing agent ("sodium tripolyphosphate") and tap water. Again, since this is not primary data, it is prone to some uncertainty. For the end of life of the product, the RTCs are sent back to the producer, where they are fully recycled into industrial pipes in-house. The paper and cardboard are both recycled by the start-up. While this information comes from internal data, the Ecoinvent recycling processes are custom and apply to the whole world (GLO), which can also cause some uncertainty.
A detailed document containing all elementary flows can be found in the Appendix.

Finally, a sensitivity analysis has been conducted, to see how strong certain impacts change when the inputs are changed. The parameters tested are the sizes of the container and lid. Since the manufacturer offers the RTCs in multiple sizes, it is interesting to look at the differences in impact intensities. If the results change a lot, it could be an indicator that purely the materials itself are having a high impact. If the results do not change proportionately to the increase of materials, it could be an indicator that rather the processes around the materials (e.g. the production machines, energy, etc) are an issue.

5. Life Cycle Assessment and Comparison

The eleven impact categories considered are abiotic depletion potential of elements (ADPe.), abiotic depletion potential of fossil resources (ADPf.), acidification potential (AP), eutrophication potential (EP), global warming potential (GWP), human toxicity potential (HTP), marine aquatic ecotoxicity potential (MAETP), freshwater aquatic ecotoxicity potential (FAETP), ozone depletion potential (ODP), photochemical oxidants creation potential (POCP) and the terrestrial ecotoxicity potential (TETP).

As shown in the following figure (Fig. 3), SAN itself has the strongest impact on four out of the eleven impact categories: ADPf., AP, GWP and POCP. Its impact gets as high as more than twice the impact of most of the other processes. Compared to the ADPf. of the study by Gallego-Schmid et al. (2019), the SAN container has a much higher impact than any of the single-use or reusable PP container (10,274,000 J compared to just above 2,000 J for the PP and below 800 J for the single-use ones). The acidification potential (AP) is also much higher for the SAN container (1206 mg SO2 eq) compared to the others (all below 400 mg SO2 eq). Similar results appear for the GWP (517 g CO2 eq compared to values below 60 g CO2 eq) and POCP (108.6 mg C2H4 eq compared to values below 60 mg C2H4 eq).

***Fig. 3**: the impact of SAN production on different impact categories.*

The end of life of the container, as shown in Fig. 4, has a big impact on three out of the eleven categories: FAETP, HTP and MAETP. For the FAETP, the end-of-life treatment of the container is about four times higher than any of the other processes. The MAETP is even about five times higher than the remaining processes, showing how high the impacts are on both fresh and marine water. In contrast to the comparison study, these values are also higher. The value for the waste treatment of PP is about 120 g 1,4-DB eq, while in this case it is 401 g 1,4-DB eq.

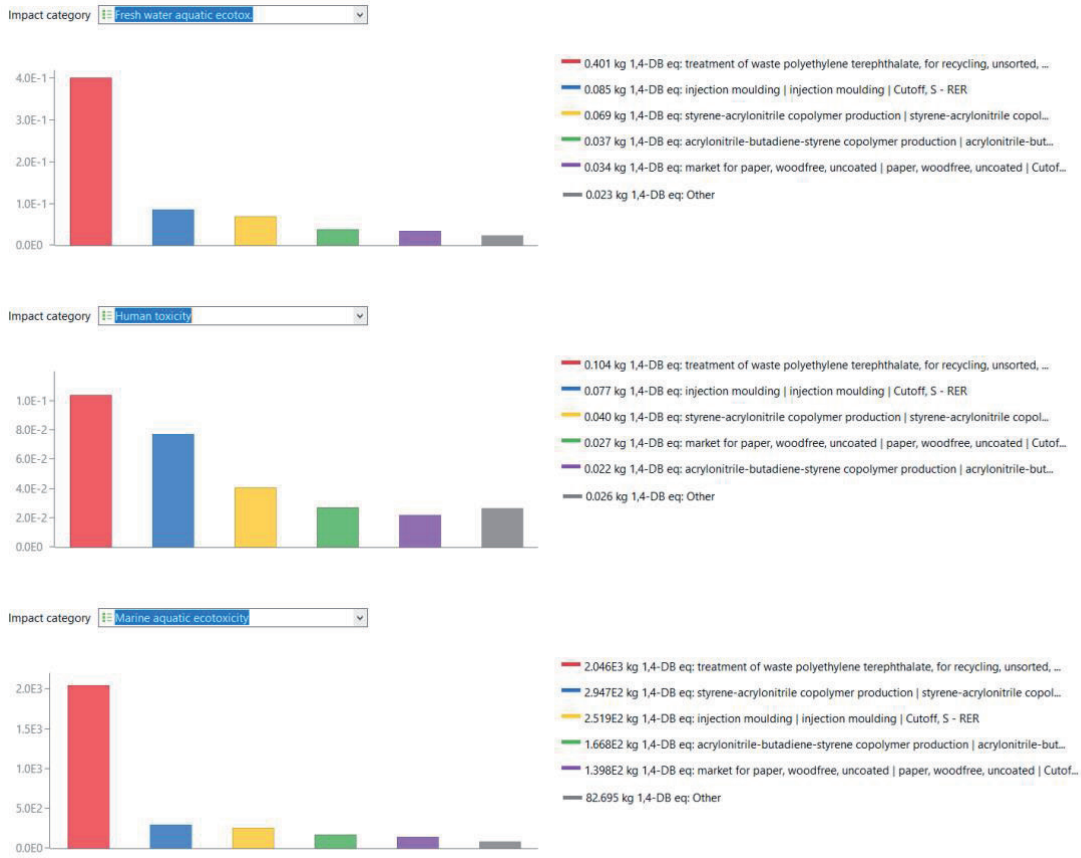

***Fig. 4**: The impact of RTCs waste treatment on different impact categories.*

Injection Molding has the highest impact in two and the second-highest impact in four of the impact categories. *Figure 5* shows the two highest impacts (ODP and EP). In addition to these, it holds the second-largest impacts on ADPe, AP, FAETP and HTP. Nevertheless, it still has a higher impact than the production processes in the comparison study (e.g. a AP value of 828.4 mg SO2 eq compared to values under 300).

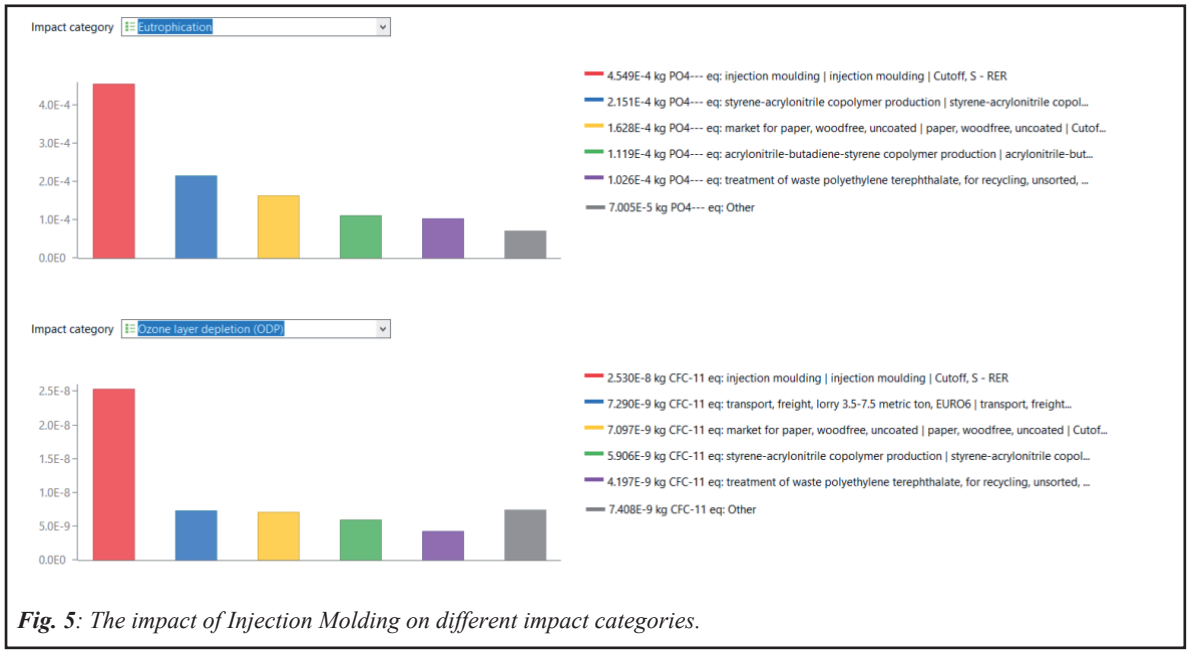

***Fig. 5**: The impact of Injection Molding on different impact categories.*

Lastly, transport with a 12t truck and the soap for the dishwasher yield the highest impact on ADPe and TETP, respectively (Figure 6 and 7). Again, both values are higher than in the comparison study (Gallego-Schmid et al, 2019).

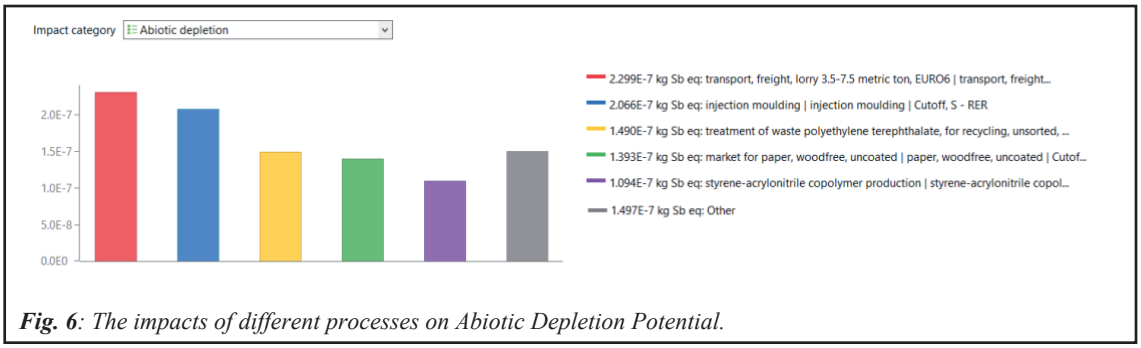

***Fig. 6**: The impacts of different processes on Abiotic Depletion Potential.*

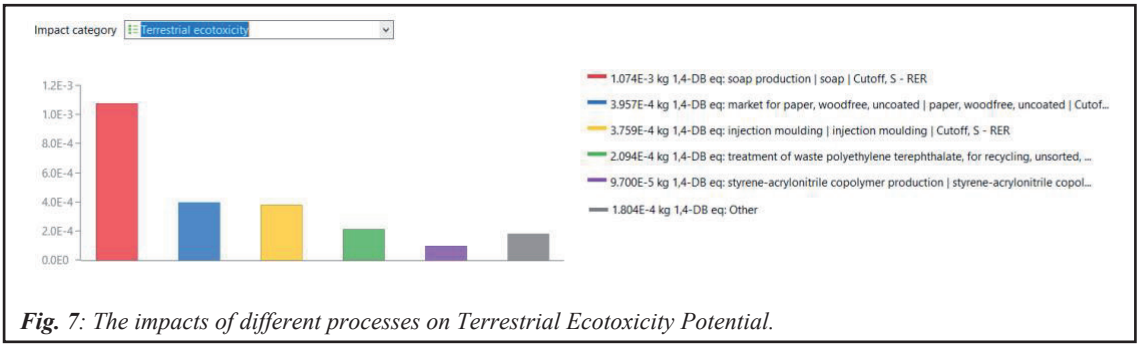

***Fig. 7**: The impacts of different processes on Terrestrial Ecotoxicity Potential.*

A detailed list of all contributing factors to the eleven impact categories (in %) as well as a detailed impact analysis list can be found in the Appendix (Apx. 2 and 3).

6. Interpretation

When looking at the outputs of the LCA, it becomes clear that certain processes have a higher environmental impact than others. Out of all raw materials for instance, SAN and TPE have a relatively high impact, while paper and cardboard have a quite small impact. At the same time, the transport with a 12t truck has some impact, while the 40t truck has very little impact. This could be an indicator for decision-makers to switch to 40t trucks for all processes. Furthermore, soap has a high impact on TETP, while the other segments of the dishwashing process have very little to no impact. Perhaps using a more environmentally friendly soap could decrease the TETP drastically. A list of the detailed impact contributions can be found in Apx. 2.

To get an even clearer understanding of which processes have a relatively high impact compared to others, groupings of the different Life Cycle Stages were analyzed in OpenLCA. The following table shows which stages are the most impactful:

Impact Category	**Life Cycle Stage with the highest impact**
ADPe.	Raw Materials
ADPf.	Raw Materials
AP	Raw Materials
EP	Raw Materials
GWP	Raw Materials
HTP	End of Life
MAETP	End of Life
FAETP	End of Life
ODP	Production
POCP	Raw Materials
TETP	Use

Tab. 2*: Most impactful Life Cycle Stages for each impact category.*

From this table it becomes clear that Raw Materials have the largest impact. Additionally, there are much higher impacts of raw materials and production, compared to the Gallego-Schmid et al. study. While this sounds discouraging at first, one needs to keep in mind that SAN is a much sturdier material than the ones of single-use containers. As for the much higher impacts of SAN compared to the reusable PP container, further research would need to be done.

To find out how much impact the raw materials themselves have, a sensitivity analysis has been done. In this analysis, the RTC (container+lid) is being compared to a RTC twice its size (measured in weight). The detailed results are available in *Apx. 4*. In the following figure, the impact changes for each impact category can be seen:

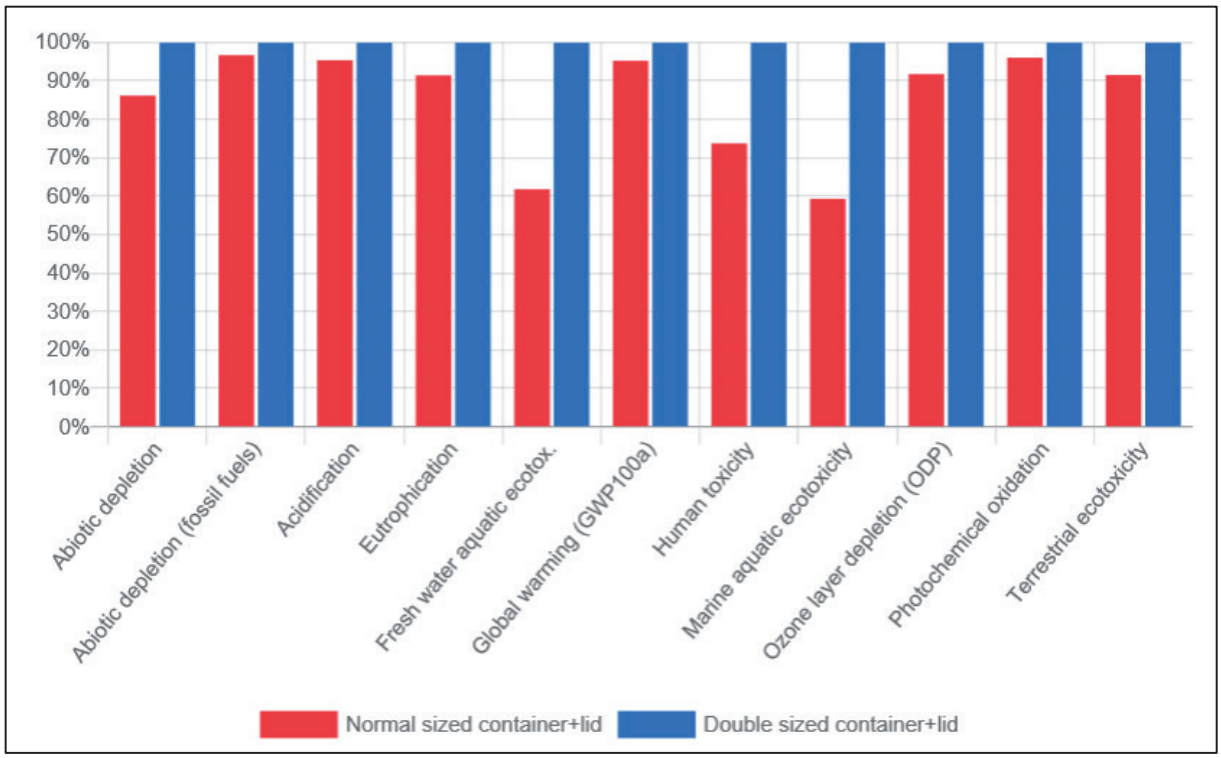

***Fig. 8**: Sensitivity analysis outcome.*

The results clearly show that for most categories, the impact does not change proportionately to the change in materials. The only categories in which it does change by 30-40% are FAETP, HTP and MAETP, which are all the categories in which the End of Life is the most impactful. This could be an indicator that for the End-of-Life processes, the pure amount of material is decisive over the impact, while other processes of the End of Life (such as energy, machinery, etc) do not play as big of a role. On the other side, for all other impact categories it means that the change in actual raw material is not very decisive over the impacts at all.

In chapter 5 one could see that the environmental impacts of SAN containers are about 3-4x higher than the ones of PP reusable containers. While these are very high values, one should not forget about the lifespan of these containers. The analyzed PP container can be reused about 43 times before having to be disposed of (Gallego-Schmid et al., 2018). At the same time, the PP container needs to be used between 1 and 208 times to outweigh the environmental advantage of single-use containers in each of the impact categories (Gallego-Schmid et al., 2019). The SAN container, however, can be reused about 1000 times since it is very durable during dish washing (G.E.T. Marketing, 2017). That means that the SAN container can be used about 23 times more often than the analyzed PP container, making it more sustainable despite its higher impacts. With this knowledge, it can easily be deduced that the consumption of SAN RTCs is, by far, more sustainable than the single-use containers compared to.

7. Conclusion and Recommendations

This LCA study was supposed to answer a few questions: Whether the analyzed RTC is more sustainable than single-use containers, and whether it is more sustainable than the reusable PP container. Furthermore, it was meant to show which of the processes regarding the RTC are the most impactful and could be improved. The first answer is: yes, the analyzed container is definitely more sustainable than the single-use alternatives, despite the higher impacts at first glance. But when considering the much longer lifespan of RTCs, it is becoming clear that they are indeed much more efficient. The second answer is positive as well: the RTC is more sustainable than the PP container from the comparison study. While the environmental impacts of the RTC are about three to four times higher, the lifespan of the RTC is about 23 times higher. Lastly, it has been shown which of the processes and Life Cycle Stages are the most and least impactful (see chapter 5 and 6).

As already mentioned in chapter 4, the lack of some primary data leads to uncertainty. For example, in Fig. 5, the impacts of Injection Molding are represented as very high, also in contrast to the comparison study. Yet, the impacts might have been smaller if the parameters for energy, that are identical with the real value, could have been chosen. It is unlikely that the results would differ to a high extent, but it is for sure something that creates some uncertainty. In general, the lack of data in some parts of the study creates an issue due to uncertainty of how the results would look like if better primary data was given. This is something worth analyzing in future studies. Moreover, it is important to note that this study compares SAN RTCs specifically with the PP Tupperware container described in the comparison study. This comparison is not representable for all PP containers, since they might differ in sturdiness or thickness, and can therefore have a longer lifespan (e.g. 1200 reuses for the virgin PP containers from GreenGrubbox. Data source: internal data through personal contact).

All in all, this study gives an overall insight into reusable containers made from SAN and TPE, as well as their environmental impacts and benefits. Further, more in-depth analyses through further studies could help create more accurate data and further close the research gap.

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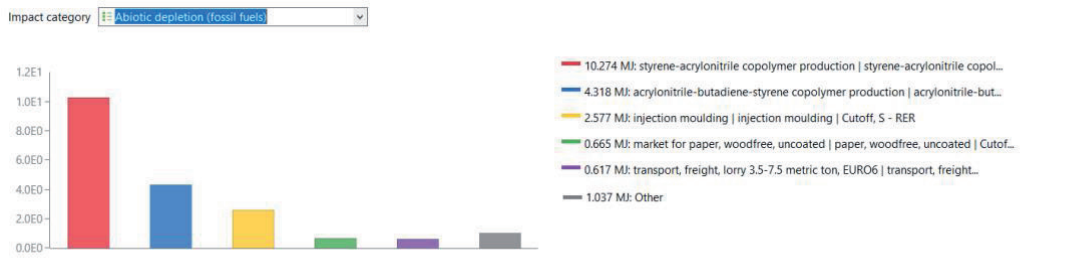
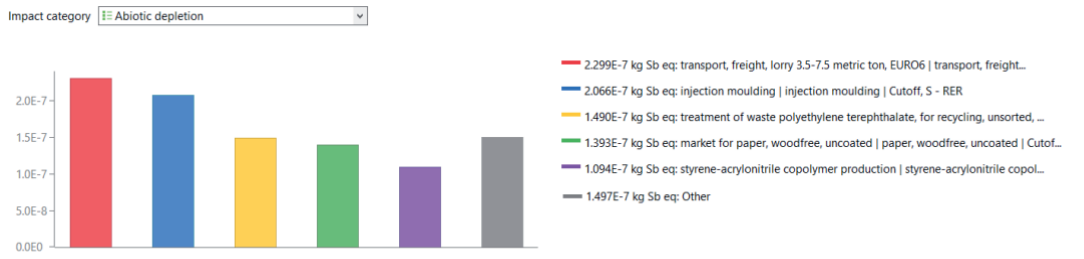
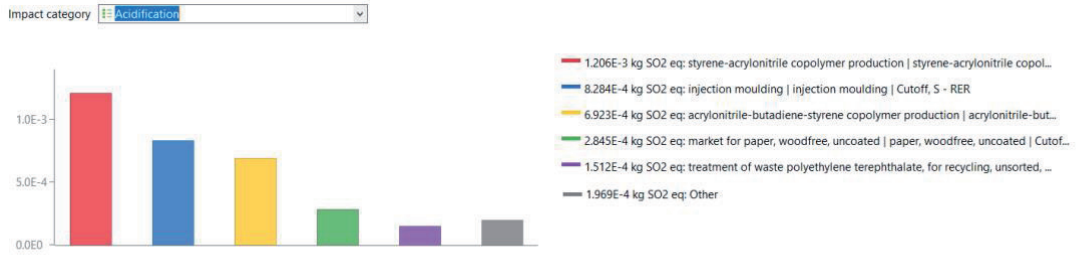
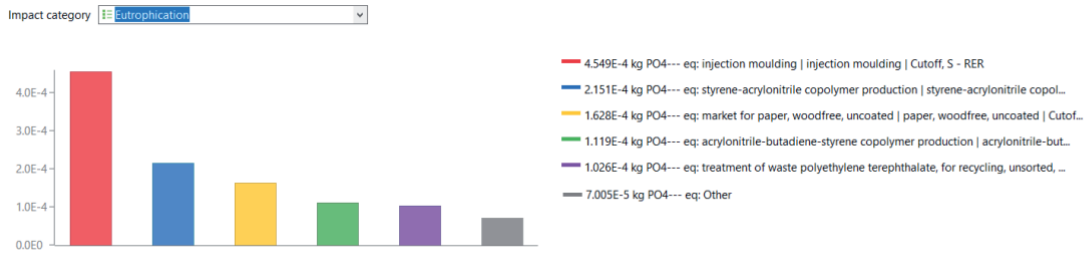
Appendix

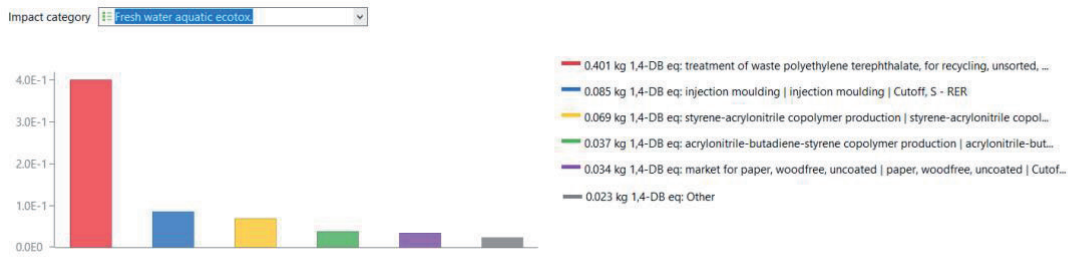
Apx. 1 – Outputs per impact category



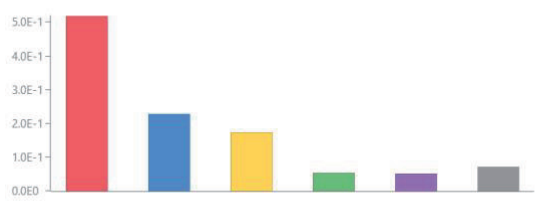






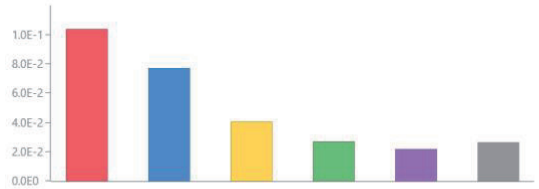


Impact category: Global warming (GWP100a)



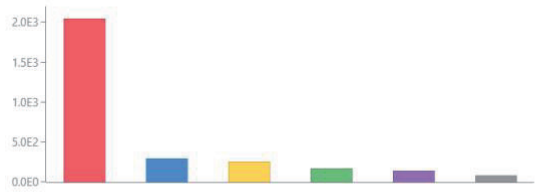
- 0.517 kg CO2 eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 0.227 kg CO2 eq: acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-but...
- 0.172 kg CO2 eq: injection moulding | injection moulding | Cutoff, S - RER
- 0.054 kg CO2 eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 0.050 kg CO2 eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 0.072 kg CO2 eq: Other

Impact category: Human toxicity



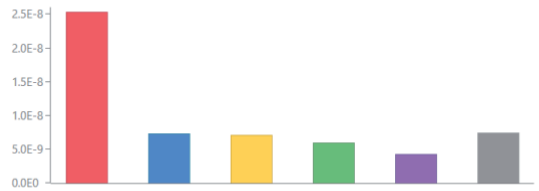
- 0.104 kg 1,4-DB eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 0.077 kg 1,4-DB eq: injection moulding | injection moulding | Cutoff, S - RER
- 0.040 kg 1,4-DB eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 0.027 kg 1,4-DB eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 0.022 kg 1,4-DB eq: acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-but...
- 0.026 kg 1,4-DB eq: Other

Impact category: Marine aquatic ecotoxicity



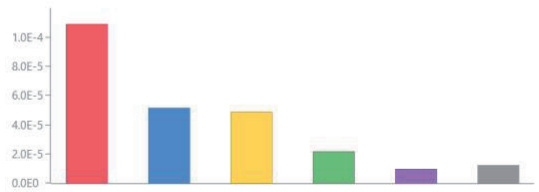
- 2.046E3 kg 1,4-DB eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 2.947E2 kg 1,4-DB eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 2.519E2 kg 1,4-DB eq: injection moulding | injection moulding | Cutoff, S - RER
- 1.668E2 kg 1,4-DB eq: acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-but...
- 1.398E2 kg 1,4-DB eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 82.695 kg 1,4-DB eq: Other

Impact category: Ozone layer depletion (ODP)



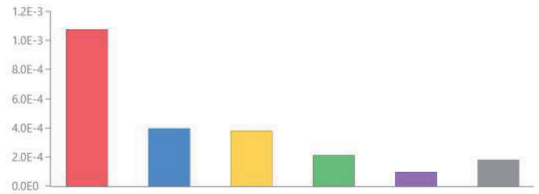
- 2.530E-8 kg CFC-11 eq: injection moulding | injection moulding | Cutoff, S - RER
- 7.290E-9 kg CFC-11 eq: transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight...
- 7.097E-9 kg CFC-11 eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 5.906E-9 kg CFC-11 eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 4.197E-9 kg CFC-11 eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 7.408E-9 kg CFC-11 eq: Other

Impact category: Photochemical oxidation



- 1.086E-4 kg C2H4 eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 5.124E-5 kg C2H4 eq: acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-but...
- 4.871E-5 kg C2H4 eq: injection moulding | injection moulding | Cutoff, S - RER
- 2.183E-5 kg C2H4 eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 9.776E-6 kg C2H4 eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 1.247E-5 kg C2H4 eq: Other

Impact category: Terrestrial ecotoxicity



- 1.074E-3 kg 1,4-DB eq: soap production | soap | Cutoff, S - RER
- 3.957E-4 kg 1,4-DB eq: market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutof...
- 3.759E-4 kg 1,4-DB eq: injection moulding | injection moulding | Cutoff, S - RER
- 2.094E-4 kg 1,4-DB eq: treatment of waste polyethylene terephthalate, for recycling, unsorted, ...
- 9.700E-5 kg 1,4-DB eq: styrene-acrylonitrile copolymer production | styrene-acrylonitrile copol...
- 1.804E-4 kg 1,4-DB eq: Other

Apx. 2 – Contribution of Processes

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	9.83791E-7	kg Sb eq
23.37%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	2.29869E-7	kg Sb eq
21.00%	injection moulding | injection moulding | Cutoff, S - RER	2.06635E-7	kg Sb eq
15.14%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	1.48969E-7	kg Sb eq
14.16%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	1.39310E-7	kg Sb eq
11.12%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	1.09351E-7	kg Sb eq
08.75%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	8.60471E-8	kg Sb eq
03.56%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	3.50272E-8	kg Sb eq
02.33%	market for corrugated board box | corrugated board box | Cutoff, S - RER	2.29418E-8	kg Sb eq
00.29%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	2.84445E-9	kg Sb eq
00.17%	soap production | soap | Cutoff, S - RER	1.66413E-9	kg Sb eq
00.09%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	9.21245E-10	kg Sb eq
00.02%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	2.09139E-10	kg Sb eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	2.11779E-12	kg Sb eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-2.92187E-23	kg Sb eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-8.43541E-23	kg Sb eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	19.48674	MJ
52.72%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	10.27383	MJ
22.16%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	4.31788	MJ
13.22%	injection moulding | injection moulding | Cutoff, S - RER	2.57653	MJ
03.41%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.66526	MJ
03.16%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	0.61651	MJ
03.05%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.59473	MJ
01.51%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	0.29407	MJ
00.73%	market for corrugated board box | corrugated board box | Cutoff, S - RER	0.14259	MJ
00.01%	soap production | soap | Cutoff, S - RER	0.00224	MJ
00.01%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	0.00187	MJ
00.00%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	0.00079	MJ
00.00%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	0.00032	MJ
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	0.00010	MJ
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-7.83498E-17	MJ
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-6.14702E-16	MJ

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.00336	kg SO2 eq
35.89%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.00121	kg SO2 eq
24.66%	injection moulding | injection moulding | Cutoff, S - RER	0.00083	kg SO2 eq
20.61%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	0.00069	kg SO2 eq
08.47%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.00028	kg SO2 eq
04.50%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.00015	kg SO2 eq
03.07%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	0.00010	kg SO2 eq
01.41%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	4.74125E-5	kg SO2 eq
01.26%	market for corrugated board box | corrugated board box | Cutoff, S - RER	4.21897E-5	kg SO2 eq
00.05%	soap production | soap | Cutoff, S - RER	1.84170E-6	kg SO2 eq
00.05%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	1.52105E-6	kg SO2 eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	3.96102E-7	kg SO2 eq
00.01%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	2.30871E-7	kg SO2 eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	4.56000E-8	kg SO2 eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-1.31162E-20	kg SO2 eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-2.06972E-19	kg SO2 eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.00112	kg PO4--- eq
40.72%	injection moulding | injection moulding | Cutoff, S - RER	0.00045	kg PO4--- eq
19.25%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.00022	kg PO4--- eq
14.57%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.00016	kg PO4--- eq
10.01%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	0.00011	kg PO4--- eq
09.18%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.00010	kg PO4--- eq
02.75%	market for corrugated board box | corrugated board box | Cutoff, S - RER	3.07330E-5	kg PO4--- eq
02.32%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	2.59039E-5	kg PO4--- eq
00.94%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	1.04974E-5	kg PO4--- eq
00.16%	soap production | soap | Cutoff, S - RER	1.82549E-6	kg PO4--- eq
00.06%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	6.70891E-7	kg PO4--- eq
00.02%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	2.11813E-7	kg PO4--- eq
00.01%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	1.52213E-7	kg PO4--- eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	5.40841E-8	kg PO4--- eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-3.28398E-21	kg PO4--- eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-1.18782E-19	kg PO4--- eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.64792	kg 1,4-DB eq
61.83%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.40063	kg 1,4-DB eq
13.05%	injection moulding | injection moulding | Cutoff, S - RER	0.08454	kg 1,4-DB eq
10.66%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.06909	kg 1,4-DB eq
05.76%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	0.03730	kg 1,4-DB eq
05.19%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.03362	kg 1,4-DB eq
01.97%	market for corrugated board box | corrugated board box | Cutoff, S - RER	0.01278	kg 1,4-DB eq
00.85%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	0.00550	kg 1,4-DB eq
00.39%	soap production | soap | Cutoff, S - RER	0.00251	kg 1,4-DB eq
00.26%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	0.00167	kg 1,4-DB eq
00.03%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	0.00019	kg 1,4-DB eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	4.89348E-5	kg 1,4-DB eq
00.01%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	3.36614E-5	kg 1,4-DB eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	7.65886E-6	kg 1,4-DB eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-6.97415E-19	kg 1,4-DB eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-7.81101E-17	kg 1,4-DB eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	1.09159	kg CO2 eq
47.36%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.51693	kg CO2 eq
20.79%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	0.22697	kg CO2 eq
15.79%	injection moulding | injection moulding | Cutoff, S - RER	0.17238	kg CO2 eq
04.91%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.05357	kg CO2 eq
04.58%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.05000	kg CO2 eq
03.85%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	0.04203	kg CO2 eq
01.64%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	0.01790	kg CO2 eq
01.04%	market for corrugated board box | corrugated board box | Cutoff, S - RER	0.01131	kg CO2 eq
00.02%	soap production | soap | Cutoff, S - RER	0.00021	kg CO2 eq
00.02%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	0.00017	kg CO2 eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	6.99498E-5	kg CO2 eq
00.00%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	3.26405E-5	kg CO2 eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	1.02834E-5	kg CO2 eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-5.34045E-18	kg CO2 eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-4.47782E-17	kg CO2 eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.29567	kg 1,4-DB eq
35.02%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.10355	kg 1,4-DB eq
26.11%	injection moulding | injection moulding | Cutoff, S - RER	0.07720	kg 1,4-DB eq
13.66%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.04038	kg 1,4-DB eq
09.05%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.02674	kg 1,4-DB eq
07.28%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	0.02154	kg 1,4-DB eq
04.29%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	0.01268	kg 1,4-DB eq
02.51%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	0.00741	kg 1,4-DB eq
01.91%	market for corrugated board box | corrugated board box | Cutoff, S - RER	0.00565	kg 1,4-DB eq
00.08%	soap production | soap | Cutoff, S - RER	0.00023	kg 1,4-DB eq
00.05%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	0.00016	kg 1,4-DB eq
00.02%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	6.10958E-5	kg 1,4-DB eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	4.30234E-5	kg 1,4-DB eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	4.78786E-6	kg 1,4-DB eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-1.61098E-18	kg 1,4-DB eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-3.23138E-17	kg 1,4-DB eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	2981.42594	kg 1,4-DB eq
68.61%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	2045.58423	kg 1,4-DB eq
09.89%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	294.72708	kg 1,4-DB eq
08.45%	injection moulding | injection moulding | Cutoff, S - RER	251.85330	kg 1,4-DB eq
05.59%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	166.80574	kg 1,4-DB eq
04.69%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	139.76034	kg 1,4-DB eq
02.08%	market for corrugated board box | corrugated board box | Cutoff, S - RER	62.00704	kg 1,4-DB eq
00.49%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	14.72616	kg 1,4-DB eq
00.17%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	5.07230	kg 1,4-DB eq
00.01%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	0.41614	kg 1,4-DB eq
00.01%	soap production | soap | Cutoff, S - RER	0.24364	kg 1,4-DB eq
00.00%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	0.12144	kg 1,4-DB eq
00.00%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	0.08852	kg 1,4-DB eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	0.02001	kg 1,4-DB eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-1.86864E-15	kg 1,4-DB eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-3.65746E-13	kg 1,4-DB eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	5.72003E-8	kg CFC-11 eq
44.23%	injection moulding | injection moulding | Cutoff, S - RER	2.53020E-8	kg CFC-11 eq
12.75%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	7.29039E-9	kg CFC-11 eq
12.41%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	7.09682E-9	kg CFC-11 eq
10.32%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	5.90589E-9	kg CFC-11 eq
07.34%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	4.19746E-9	kg CFC-11 eq
06.28%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	3.59356E-9	kg CFC-11 eq
04.22%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	2.41478E-9	kg CFC-11 eq
02.35%	market for corrugated board box | corrugated board box | Cutoff, S - RER	1.34240E-9	kg CFC-11 eq
00.06%	soap production | soap | Cutoff, S - RER	3.27920E-11	kg CFC-11 eq
00.02%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	1.37294E-11	kg CFC-11 eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	7.21151E-12	kg CFC-11 eq
00.00%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	2.79277E-12	kg CFC-11 eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	4.96209E-13	kg CFC-11 eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-9.26615E-25	kg CFC-11 eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-5.91622E-24	kg CFC-11 eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.00025	kg C2H4 eq
42.99%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	0.00011	kg C2H4 eq
20.28%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	5.12443E-5	kg C2H4 eq
19.28%	injection moulding | injection moulding | Cutoff, S - RER	4.87130E-5	kg C2H4 eq
08.64%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	2.18306E-5	kg C2H4 eq
03.87%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	9.77609E-6	kg C2H4 eq
02.67%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	6.75696E-6	kg C2H4 eq
01.11%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	2.81212E-6	kg C2H4 eq
01.00%	market for corrugated board box | corrugated board box | Cutoff, S - RER	2.53016E-6	kg C2H4 eq
00.11%	soap production | soap | Cutoff, S - RER	2.76006E-7	kg C2H4 eq
00.03%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	6.37800E-8	kg C2H4 eq
00.01%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	2.28882E-8	kg C2H4 eq
00.00%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	9.87292E-9	kg C2H4 eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	8.96778E-10	kg C2H4 eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-8.58746E-22	kg C2H4 eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-1.34035E-20	kg C2H4 eq

Contribution	Process	Amount	Unit
100.00%	Production of container - RER	0.00233	kg 1,4-DB eq
46.05%	soap production | soap | Cutoff, S - RER	0.00107	kg 1,4-DB eq
16.96%	market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutoff, S - RER	0.00040	kg 1,4-DB eq
16.12%	injection moulding | injection moulding | Cutoff, S - RER	0.00038	kg 1,4-DB eq
08.98%	treatment of waste polyethylene terephthalate, for recycling, unsorted, sorting | waste polyethylene terephthalate, ...	0.00021	kg 1,4-DB eq
04.16%	styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolymer | Cutoff, S - RER	9.70031E-5	kg 1,4-DB eq
02.68%	transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry 3.5-7.5 metric ton, EURO6 | Cutoff, S - RER	6.26023E-5	kg 1,4-DB eq
01.95%	market for corrugated board box | corrugated board box | Cutoff, S - RER	4.55786E-5	kg 1,4-DB eq
01.88%	acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-butadiene-styrene copolymer | Cutoff, S - RER	4.39236E-5	kg 1,4-DB eq
01.15%	transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >32 metric ton, EURO6 | Cutoff, S - RER	2.67372E-5	kg 1,4-DB eq
00.03%	market for tap water | tap water | Cutoff, S - Europe without Switzerland	8.13394E-7	kg 1,4-DB eq
00.03%	sodium tripolyphosphate production | sodium tripolyphosphate | Cutoff, S - RER	5.97709E-7	kg 1,4-DB eq
00.01%	sodium chloride production, powder | sodium chloride, powder | Cutoff, S - RER	1.47281E-7	kg 1,4-DB eq
00.00%	market for electricity, high voltage | electricity, high voltage | Cutoff, S - DE	1.21946E-8	kg 1,4-DB eq
-00.00%	waste paperboard, sorted, Recycled Content cut-off | waste paperboard, sorted | Cutoff, S - GLO	-7.95553E-21	kg 1,4-DB eq
-00.00%	waste packaging paper, Recycled Content cut-off | waste packaging paper | Cutoff, S - GLO	-1.75103E-19	kg 1,4-DB eq

Apx. 3 – Impact Category Results

Name	Category	Impact result	Unit
Terrestrial ecotoxicity		0.00233	kg 1,4-D...
Abiotic depletion (fossil fuels)		19.48674	MJ
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	10.27383	MJ
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	4.31788	MJ
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	2.57653	MJ
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.66526	MJ
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	0.61651	MJ
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.59473	MJ
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...	0.29407	MJ
Marine aquatic ecotoxicity		2981.42594	kg 1,4-D...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	2045.58423	kg 1,4-D...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	294.72708	kg 1,4-D...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	251.85330	kg 1,4-D...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	166.80574	kg 1,4-D...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	139.76034	kg 1,4-D...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	62.00704	kg 1,4-D...
Human toxicity		0.29567	kg 1,4-D...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.10355	kg 1,4-D...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	0.07720	kg 1,4-D...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	0.04038	kg 1,4-D...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.02674	kg 1,4-D...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	0.02154	kg 1,4-D...
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	0.01268	kg 1,4-D...
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...	0.00741	kg 1,4-D...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	0.00565	kg 1,4-D...

Name	Category	Inventory result	Impact factor	Impact result	Unit
Photochemical oxidation				0.00025	kg C2H4 ...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...			0.00011	kg C2H4 ...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...			5.12443E-5	kg C2H4 ...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...			4.87130E-5	kg C2H4 ...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...			2.18306E-5	kg C2H4 ...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...			9.77609E-6	kg C2H4 ...
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...			6.75696E-6	kg C2H4 ...
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...			2.81212E-6	kg C2H4 ...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...			2.53016E-6	kg C2H4 ...
Ozone layer depletion (ODP)				5.72003E-8	kg CFC-1...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...			2.53020E-8	kg CFC-1...
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...			7.29039E-9	kg CFC-1...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...			7.09682E-9	kg CFC-1...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...			5.90589E-9	kg CFC-1...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...			4.19746E-9	kg CFC-1...
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...			3.59356E-9	kg CFC-1...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...			2.41478E-9	kg CFC-1...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...			1.34240E-9	kg CFC-1...
Terrestrial ecotoxicity				0.00233	kg 1,4-D...
soap production | soap | Cutoff, S - RER	202:Manufacture of other chemical products ...			0.00107	kg 1,4-D...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...			0.00040	kg 1,4-D...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...			0.00038	kg 1,4-D...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...			0.00021	kg 1,4-D...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...			9.70031E-5	kg 1,4-D...
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...			6.26023E-5	kg 1,4-D...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...			4.55786E-5	kg 1,4-D...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...			4.39236E-5	kg 1,4-D...
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...			2.67372E-5	kg 1,4-D...

Abiotic depletion		9.83791E-7	kg Sb eq
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	2.29869E-7	kg Sb eq
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	2.06635E-7	kg Sb eq
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	1.48969E-7	kg Sb eq
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	1.39310E-7	kg Sb eq
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	1.09351E-7	kg Sb eq
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	8.60471E-8	kg Sb eq
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...	3.50272E-8	kg Sb eq
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	2.29418E-8	kg Sb eq
Eutrophication		0.00112	kg PO4--...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	0.00045	kg PO4--...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	0.00022	kg PO4--...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.00016	kg PO4--...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	0.00011	kg PO4--...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.00010	kg PO4--...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	3.07330E-5	kg PO4--...
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	2.59039E-5	kg PO4--...
Fresh water aquatic ecotox.		0.64792	kg 1,4-D...
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.40063	kg 1,4-D...
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	0.08454	kg 1,4-D...
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	0.06909	kg 1,4-D...
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	0.03730	kg 1,4-D...
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.03362	kg 1,4-D...
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	0.01278	kg 1,4-D...

Acidification		0.00336	kg SO2 eq
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	0.00121	kg SO2 eq
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	0.00083	kg SO2 eq
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	0.00069	kg SO2 eq
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.00028	kg SO2 eq
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.00015	kg SO2 eq
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	0.00010	kg SO2 eq
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...	4.74125E-5	kg SO2 eq
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	4.21897E-5	kg SO2 eq
Global warming (GWP100a)		1.09159	kg CO2 eq
styrene-acrylonitrile copolymer production | styrene-acrylonitrile copolyn	201:Manufacture of basic chemicals, fertilize...	0.51693	kg CO2 eq
acrylonitrile-butadiene-styrene copolymer production | acrylonitrile-buta	201:Manufacture of basic chemicals, fertilize...	0.22697	kg CO2 eq
injection moulding | injection moulding | Cutoff, S - RER	222:Manufacture of plastics products / 2220:...	0.17238	kg CO2 eq
market for paper, woodfree, uncoated | paper, woodfree, uncoated | Cutc	170:Manufacture of paper and paper produc...	0.05357	kg CO2 eq
treatment of waste polyethylene terephthalate, for recycling, unsorted, so	381:Waste collection / 3811:Collection of no...	0.05000	kg CO2 eq
transport, freight, lorry 3.5-7.5 metric ton, EURO6 | transport, freight, lorry	492:Other land transport / 4923:Freight trans...	0.04203	kg CO2 eq
transport, freight, lorry >32 metric ton, EURO6 | transport, freight, lorry >3	492:Other land transport / 4923:Freight trans...	0.01790	kg CO2 eq
market for corrugated board box | corrugated board box | Cutoff, S - REF	170:Manufacture of paper and paper produc...	0.01131	kg CO2 eq

Apx. 4 – Sensitivity Analysis Results

Indicator	Normal sized container+lid	Double sized container+lid	Unit
Abiotic depletion	9.83791e-7	1.14207e-6	kg Sb eq
Abiotic depletion (fossil fuels)	1.94867e+1	2.01596e+1	MJ
Acidification	3.35883e-3	3.52262e-3	kg SO2 eq
Eutrophication	1.11725e-3	1.22260e-3	kg PO4--- eq
Fresh water aquatic ecotox.	6.47916e-1	1.04899e+0	kg 1,4-DB eq
Global warming (GWP100a)	1.09159e+0	1.14635e+0	kg CO2 eq
Human toxicity	2.95665e-1	4.01189e-1	kg 1,4-DB eq
Marine aquatic ecotoxicity	2.98143e+3	5.02836e+3	kg 1,4-DB eq
Ozone layer depletion (ODP)	5.72003e-8	6.23524e-8	kg CFC-11 eq
Photochemical oxidation	2.52662e-4	2.63185e-4	kg C2H4 eq
Terrestrial ecotoxicity	2.33254e-3	2.54905e-3	kg 1,4-DB eq