Re_fashion

Characterisation study of the incoming and outgoing streams from sorting facilities

Summary Report

April 2023

Terra

Experts en solutions circulaires

CONTENTS

Acknowledgements

Refashion would like to thank this programme's partner sorting facilities for having provided the streams for the composition analyses reproduced in this report.

Background, objectives and methodology

Background and objectives

The producer responsibility organisation (eco-organisation) Refashion wanted to update *the results of the characterisation programme of the incoming streams and outgoing waste from sorting facilities undertaken with the help of Terra in 2013*[1], and to extend the analysis to the composition of all outgoing streams, distinguishing reuse and non-reuse fractions.

In April 2021, Refashion commissioned the launch of a programme to analyse the composition of incoming and outgoing streams from sorting centres contracted with Refashion, in order to meet the objectives below.

Incoming streams

- To update the information on composition of the CHF (Clothing, Household linen and Footwear) streams collected in France today according to the categories and sub-categories of the Refashion upstream fee scale (product classification system).
- To understand any differences in the composition of collected streams according to their collection source (containers located on public/private locations, charities, municipal waste collection facilities, in-store collection, etc.).

Outgoing streams

- To have clear information on the average distribution of end destinations (reuse, garnetting, wiping cloths, SRF[2], ultimate waste) for the various types of items of the Refashion product classification.
- To have clear information on material composition of the non-reusable streams so to help accelerate the work on material recycling.

How this study was undertaken

This study was carried out from May 2021 to January 2022.

Practically, Refashion analysed the composition of streams from a panel of sorting centres contracted with the eco-organisation, enabling to evaluate different collection sources, different geographical zones, different collection seasons and different sorting systems.

The results of the study are the consolidated results of the streams analysed from the different partner sorting centres, which have been anonymised.

[1] https://refashion.fr/pro/sites/default/files/rapport-etude/RESULTAT_Rapport_Caracterisation_flux_entrants_et_dechets_TLC_web_0.pdf
[2] SRF = Solid Recovered Fuel

General methodology

The programme involved:

- 6 sorting centres contracted with Refashion
- 3 external analysis centres specifically trained in:
  - composition analysis according to the item sub-categories of the Refashion product classification.
  - the use of a near-infrared spectrometer, recognition equipment for material analysis.

The partner sorting centres

The assistance requested from each sorting centre focused on the following:

- To provide 20 tonnes of incoming streams (2 batches of 10 tonnes, at 2 different times of the year)

Prior to the provision of the streams:

- To identify the 20 tonnes according to the different collection sources (containers, municipal waste collection facilities, charities, etc.).
- To store the streams in an area separate from the rest of the sorting centre, with a separate storage per collection source type for the pre-sorting stage below.
- To pre-sort the 20 tonnes according to the sorting centre's own sorting instructions so to provide the pre-sorted batches per end destination category (reuse, garnetting, wiping cloths, SRF, ultimate waste, packaging for recycling) and do this for each of the aforementioned collection sources.

General stages

The following overview diagram (Figure 1) shows the general stages of the implemented incoming and outgoing streams characterisation process.

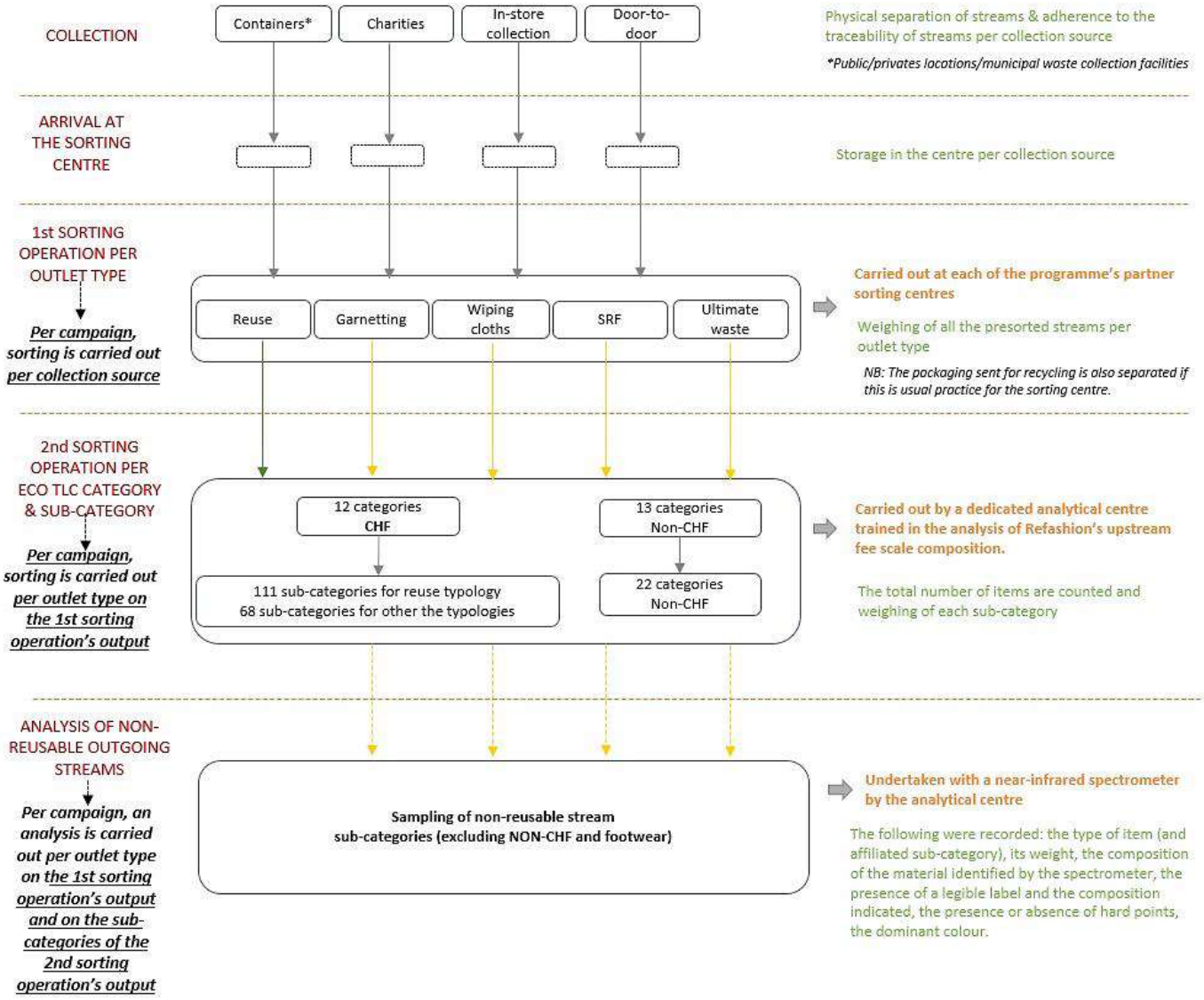


Figure 1: General stages in the incoming and outgoing streams characterisation process

Incoming streams methodology

Scope of analysed streams

The **analysed streams aimed at covering a maximum of configurations** so to reflect the diversity of the streams collected by the sorting centres contracted with Refashion.

- **Type of stream**: original items collected and skimmed items[3]
- **Collection source**[4]: Containers on public locations (excluding municipal waste collection facilities), containers on private locations, containers in municipal waste collection facilities, in-store collection, charities.
- **End destination of streams after sorting:** reuse, garnetting, wiping cloths, solid recovered fuel (SRF), ultimate waste, packaging (for recycling)
- **Geographical zone of collection:** Northern/southern mainland France
- **Seasonality of collection:** collected streams analysed for the 4 quarters.

Furthermore, the partner sorting centres have different configurations: small and large capacities, centres specialised in 'original' items or skimmed items, France and abroad, independent operators and members of networks.

Data collected for incoming streams

The **weight** and the **number of items per product line of the Refashion classification system** were recorded for each analysed batch. An **"average weight/item"** was calculated based on this information.

Data adjustment

However, the breakdown of the analysed streams differs from:

- the **national average breakdown of collected streams per collection source,**
- the **average breakdown per end destination of streams sorted by operators contracted with Refashion**.

The programme's data has thereby been adjusted using a **statistical margin calibration method**, aiming at weighing the obtained results according to the previously cited known distribution averages (collection source and end destination = calibration variables).

It should also be noted that a statistical analysis of influencing factors was undertaken and showed **that there is no influence of collection seasonality on the composition of incoming streams.** (NB: Each quarter has been allotted 25% of the collected and analysed streams.)

Results accuracy

Data processing, including adjustment using the margin calibration method, was undertaken to make the study's results as robust as possible. Analyses of the statistical margin of accuracy were carried out on the incoming and outgoing stream results and **validated the robustness of the data**[5] included in this overview.

[3] Original items collected = textiles arriving at the sorting centre and that are the direct result of collection; skimmed items = items where first-grade or high-quality "cream" items have been removed before arriving at the sorting centre

[4]: It was not possible to analyse door-to-door collection in this programme.

[5]The margins of accuracy are sufficiently close to the average proportions because these never exceed plus or minus 4 points around the average proportion.

Outgoing streams methodology

Scope of analysed outgoing streams

Only the non-reusable outgoing streams from sorting centres were analysed.

Footwear and non-CHF items were not analysed.

Sampling of outgoing streams

Analysing outgoing streams requires that information be recorded item by item. Random sampling was therefore carried out for each product category with a sampling rate between 20 and 100%. Data was then adjusted to take into account this sampling rate.

Data collected for outgoing streams

The weight, material composition and other characteristics were recorded for each analysed textile item (details can be found in the appendix).

Material composition recording

Material composition was systematically recorded twice:

- when present and legible, the item **label** was read;
- material composition was detected with an **infrared spectrometer**.

The following table shows the distribution of information on materials.

in weight *in number of items*	Label	No label	Total
Detection with the spectrometer	48% *39%*	37% *47%*	**85%** *86%*
No detection by the spectrometer	6% *5%*	8% *9%*	**15%** *14%*
Total	**54%** *43%*	**46%** *57%*	

Limitations of these compositions

Using a spectrometer more often gives information on material composition as labels are only present or legible on 43% of the analysed items. This corresponds to 54% of the total weight because labels are more often present on large items (e.g. coats) than on smaller ones (e.g. socks).

The non-detection of material composition by the spectrometer (15% in weight) can be explained by some pigments present in textiles or the complex blends that the spectrometer cannot recognise.

The used spectrometer also has some limitations[6] such as the incapacity to detect blends containing more than two materials or the poor detection of elastane in low proportions.

Consolidated material composition

An adjustment of material composition data given by the spectrometer was undertaken through information collected on items where both compositions were available (48% of the total in weight).

For example, 10% of T-shirts were recognised by the spectrometer as being 100% cotton but were in fact made from a cotton/elastane blend.

The material composition results given in this report correspond to the **corrected and consolidated material composition values.**

In the end, the combined use of a spectrometer and labels reduced the number of items without material information (**91.5% of the bulk of analysed outgoing streams with material composition**) whilst having a level of detail which could not have been reached by using one source of information only.

[6] FabriTell Spectrometer by Matoha which limitations are detailed here: https://matoha.com/fabrics-identification-information

Textile materials categories

Given the large number of materials existing within textiles, some have been grouped together for a better readability of results.

The **9 selected material categories** are:

- cotton
- polyester
- acrylic
- viscose
- wool
- polyamide
- elastane
- silk
- acetate

In addition, 2 other categories were introduced: "other" and "unknown".

All other materials (e.g. linen, ramie, chlorofibre, metallised fibre, PP, etc.) have been grouped under the same name "**other**". However, this accounts for less than 2% of the analysed textiles.

The term "**unknown**" is used for compositions that could not be identified (no label and no spectrometer recognition).

The term **viscose** covers all man-made cellulosic fibres such as lyocell, modal or cupro.

Similarly, the term **wool** groups together all animal-hairs fibres (cashmere, angora, mohair, etc.).

Incoming streams composition results

Analysed streams analysed

122 tonnes were analysed representing around 720,000 items in the incoming streams.

Composition per main category

Composition results - based on 100 CHF and non-CHF items

The relative share of CHF and non-CHF in weight and number of items is shown hereafter.

CHF accounts for 90.9% of the incoming weight and 89.1% in number of items.

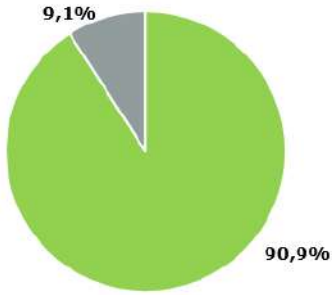


Figure 2: Breakdown of CHF and non-CHF in weight

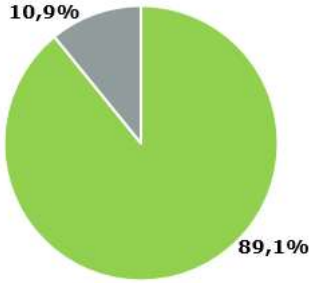


Figure 3: Breakdown of CHF and non-CHF in number of items

Composition results - 100 items basis excluding non-CHF items

The relative share of each CHF per category in weight and in number of items is shown hereafter.

In weight, clothing is dominant accounting for 79.7% of incoming streams, followed by footwear at 10.5% and household linen at 9.8%.

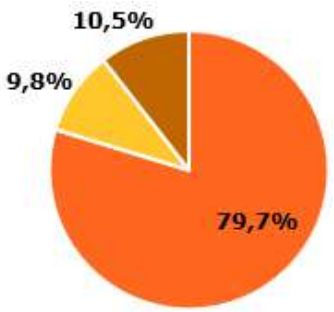


Figure 4: Breakdown of CHF in weight

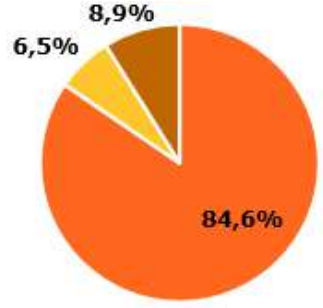


Figure 5: Breakdown of CHF in number of items

Average weight

The average weight per CHF category is as follows:

- Clothing: 171 g/item
- Household linen: 282 g/item
- Footwear: 238g/shoe, i.e. 475 g/pair

Comparison with data from the 2013 programme

Curtains and net curtains are identified as household linen in the 2021 Refashion classification system, which is the basis of the product categorisation used in this study. In the composition per category results shown above, they have been integrated into the household linen category.

However, to compare with the 2013 data, curtains and net curtains are included in non-CHF[7] as it was the case in 2013.

[7] It should be noted that since the publication of French decree n° 2022-975 on furnishings EPR, curtains and net curtains are now included in the furnishings EPR scheme.

	2022 results		2013 results		2022 versus 2013 percentage differences	
	% weight	% number	% weight	% number	% weight	% number
Clothing	72.4%	75.3%	79.9%	86.2%	-7.5	-10.9
HH Linen	7.9%	5.3%	7.5%	5.4%	0.4	-0.1
Footwear	9.6%	7.9%	5.4%	3.4%	4.2	4.5
CHF	**89.9%**	**88.6%**	**92.8%**	**95.0%**	**-2.9**	**-6.4**
Non-CHF	10.1%	11.4%	7.2%	5.0%	2.9	6.4

A decrease in the share of clothing, a slight increase in weight of household linen and an increase in the share of footwear can be observed. The share of CHF is declining in weight and in number.

Composition per product category

The analysis per CHF product:

- follows the simplified categories from the 2021 Refashion product classification system.
- is given in % of the analysed weight.

The details of products corresponding to each simplified category are available in the appendix.

CHF breakdown

The 4 main simplified product categories are "pullover-type tops" (14.6%), "Other trousers, shorts and skirts" (11.8%), "T-shirt type tops" (11.3%) and "Jackets, coats and suits" (10.3%).

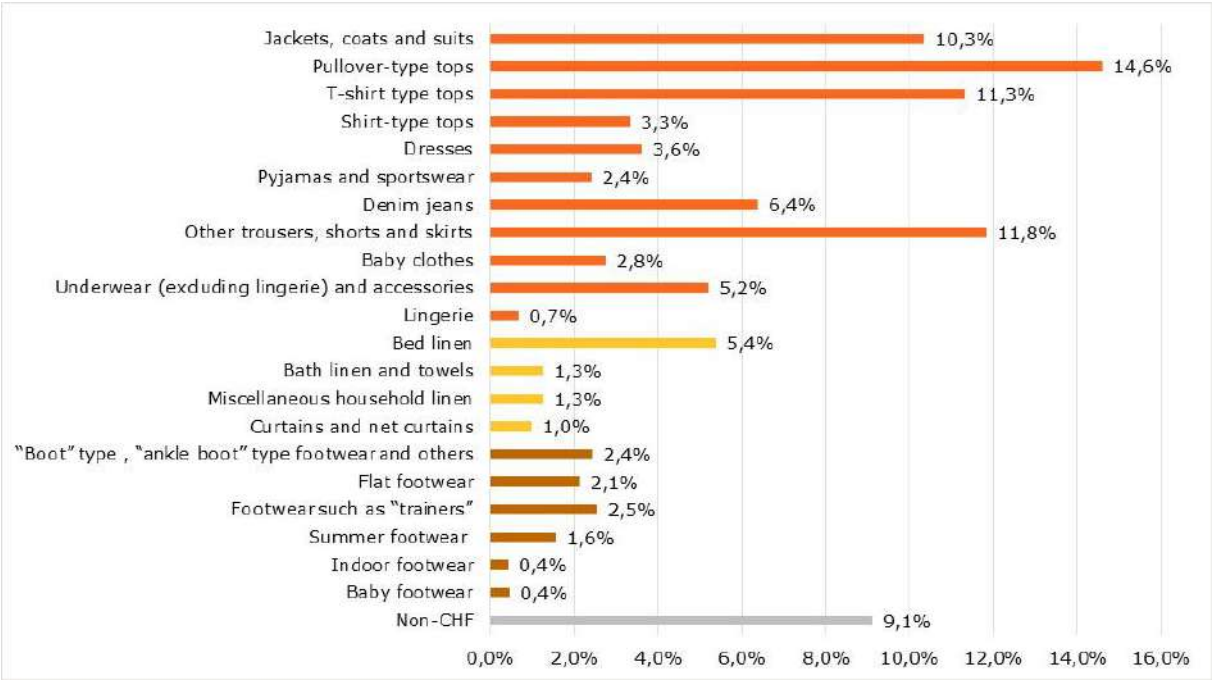


Figure 6: Composition of incoming streams per simplified product category

Non-CHF breakdown

The graph below shows the breakdown of non-CHF in weight.

5 out of 12 categories account for around 75% of non-CHF in weight: leather goods at nearly 25%; cushions, duvets and pillows at 20%; fabric off-cuts at 14%; and Others and packaging at 10% and 8% respectively.

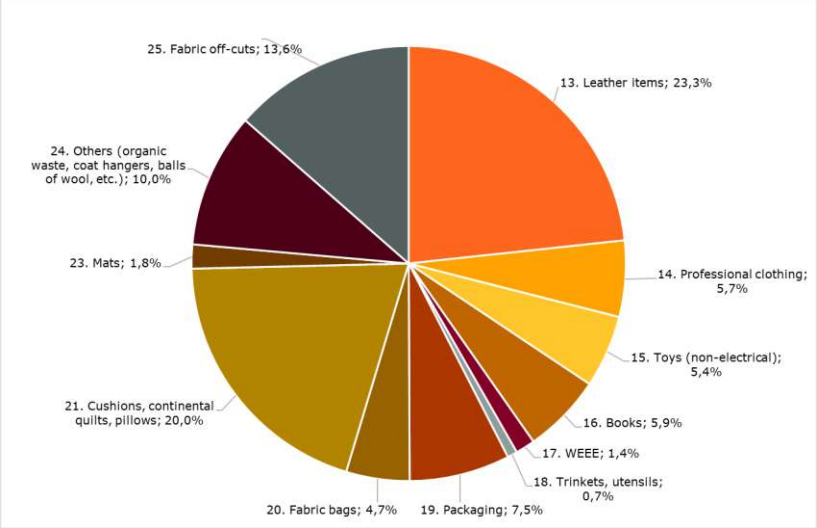


Figure 7: Breakdown in weight of non-CHF in incoming streams

Outgoing streams composition results

Analysed streams

The outgoing streams from sorting centres that were subject to more in-depth characterisation are **non-reusable streams**, i.e. the following sorted textile streams:

- Garnetting/tearing (recycling)
- Wiping cloths (recycling)
- SRF preparation (solid recovered fuel)
- Ultimate waste (incineration or landfilling)

Footwear and non-CHF items were excluded from this analysis.

Quantities analysed

A bit more than **74,000 items** were analysed, i.e. nearly **14.6 t**.

Multilayers

Multilayered items (see details in the appendix) account for 3% of the analysed items, which corresponds to 8% of the total weight.

The average weight of multilayered items (589 g/item) is indeed higher than the average (196 g/item).

Overall material composition

Cotton is the **dominant material** (43%) in the analysed non-reusable textile waste.

It is followed by **polyester** (19%), **acrylic** (12%), **man-made cellulosic fibres**[8], wool, then polyamide. Each of the other fibres account for less than 1% of the analysed amount (elastane accounts for 0.7% of the weight, "other" materials for 0.7%, silk for 0.4% and acetate for 0.2%).

The material composition of 8.5% of the analysed textiles **could not be identified** due to the absence of a label together with the non-detection of materials by the spectrometer ("unknown" category).

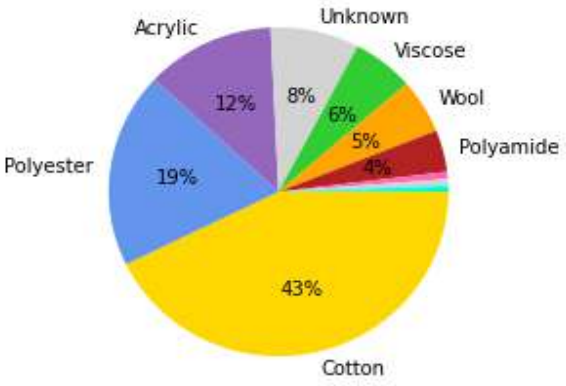


Figure 8: Overall material composition of the analysed streams (in weight)

Overview per end destination – overall composition

The following graph shows the breakdown of materials for each end destination of sorted streams.

Cotton is highly dominant in the wiping cloths stream. Its is also the dominant material in the garnetting and ultimate waste streams.

Polyester is the main material in the SRF stream, it is also over-represented in ultimate waste.

Acrylic and **wool** are over-represented in the garnetting stream.

[8] As a reminder: all man-made cellulosic fibres (viscose, lyocell, modal, cupro) have been grouped together under the name "viscose" in the various results shown.

Man-made cellulosic fibres represent a roughly equivalent share regardless of the stream.

The proportion of **unidentified materials** ("unknown" category) is higher in the ultimate waste and SRF streams.

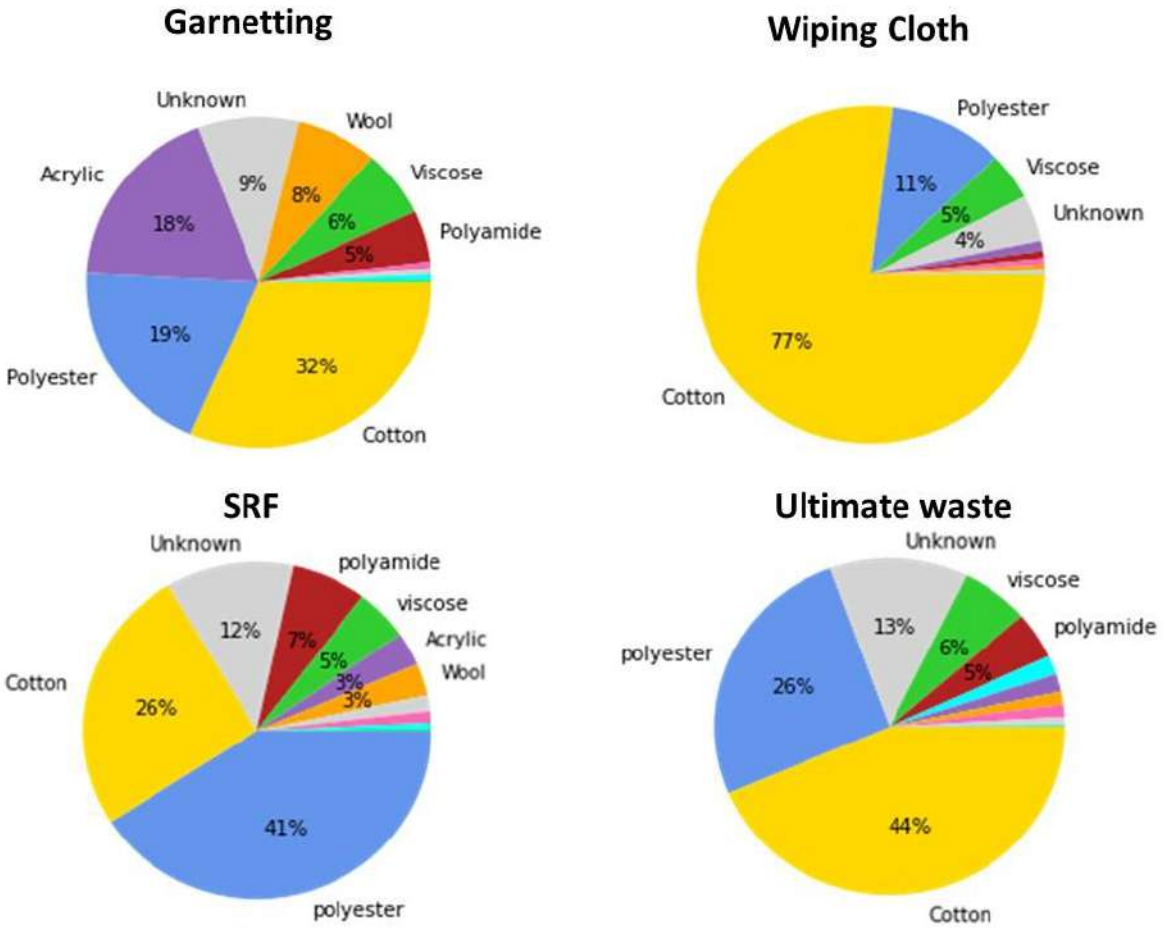


Figure 9: Overall material composition per end destination of sorted streams (in weight)

Main compositions

The detailed material compositions were also analysed to highlight the main material blends that can be found in the different streams.

Blends

By removing non-identified materials (8.5%), we can see that **blends** account for around **45%** of the **non-reusable textile feedstock.**

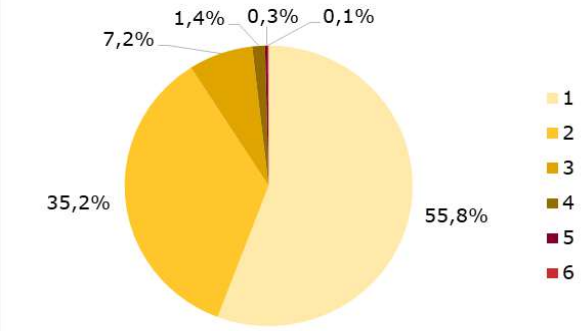


Figure 10: Number of materials in identified compositions (100 items basis excluding unknown items, in weight)

Blends of two materials are more frequent, accounting for slightly more than one third of the non-reusable feedstock (35.2%). Blends with **four or more materials** account for less than 2% of the feedstock.

The most frequent compositions

100% cotton is the most common composition at around slightly less than 30% of the feedstock. **100% polyester** arrives in second place (11%).

This more in-depth analysis highlights the significant share of some blends:

- **cotton/polyester** accounts for nearly 9% of the feedstock;
- **cotton/elastane** accounts for nearly 5% of the feedstock;
- the third most frequent blend is **cotton/polyester/elastane**.

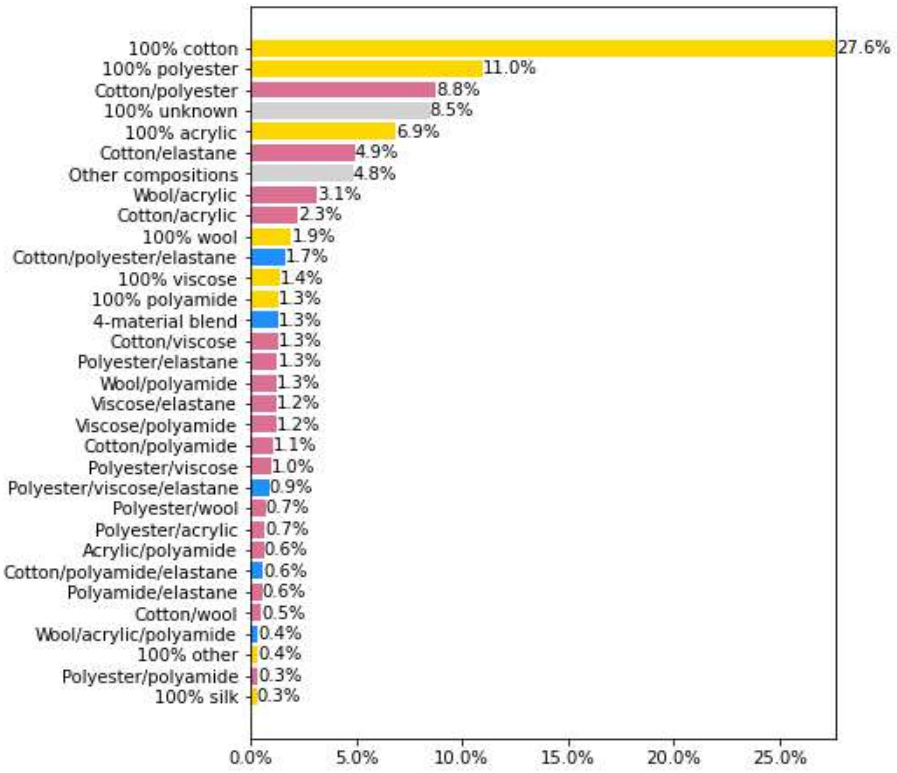


Figure 11: Main compositions (accounting for 95% of the textile non-reusable feedstock, in weight).

*Colour code: **yellow** = pure material; **pink** = two-material blend; **blue** = three or more material blend*

Synthetic materials

It should be noted that, in this analysis, items **composed of more than 90% synthetic materials** (polyester, polyamide, acrylic, elastane) account for **24% of non-reusable clothing and household linen**.

Spectrometer versus labels

The comparison between material compositions given on the labels and detected by the spectrometer confirmed the effectiveness of the latter.

The results for the overall material composition (see Figure 8) are indeed very close for both methods (spectrometer-only or labels-only).

But differences are more significant when looking at the exact material compositions (see Figure 11).

The spectrometer thereby enables the correct identification of dominant materials but requires more accuracy to identify the subtleties of some blends, such as those with a low elastane proportion.

Distribution of materials contained in the blends

The graph below details the composition of the main blends with the **average distribution of the different fibres** within the blends.

For example, cotton is most often the dominant material in cotton/polyester blends (an average of 57% cotton).

Elastane is present in very low amounts in cotton/elastane blends (an average of 4%).

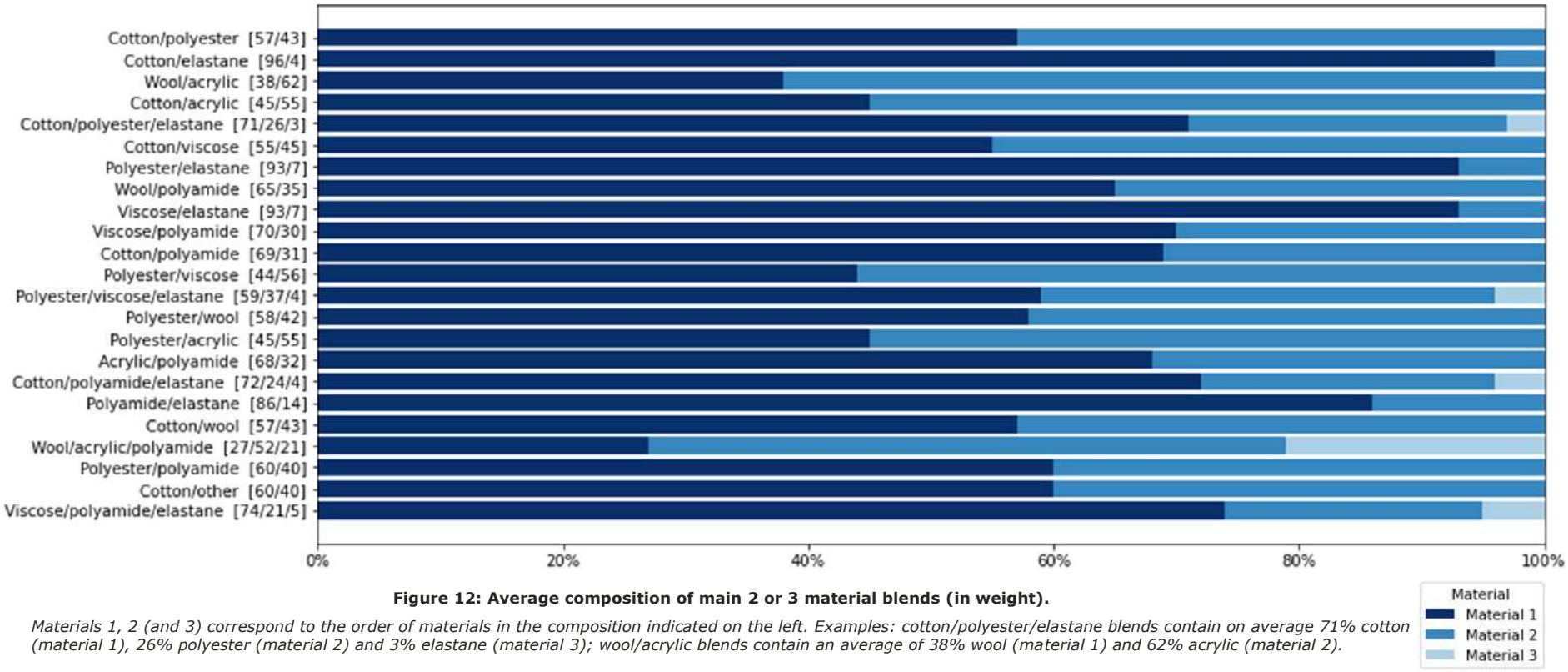


Figure 12: Average composition of main 2 or 3 material blends (in weight).

Materials 1, 2 (and 3) correspond to the order of materials in the composition indicated on the left. Examples: cotton/polyester/elastane blends contain on average 71% cotton (material 1), 26% polyester (material 2) and 3% elastane (material 3); wool/acrylic blends contain an average of 38% wool (material 1) and 62% acrylic (material 2).

Recyclability

To gain a better understanding of the **recycling potential** of non-reusable textiles, the following characteristics were captured:

- single layered or multilayered item,
- the presence of disruptors to recycling (external disruptors)[9],
- colour.

Multilayers and disruptors

Multilayered items account for 8.5% of the analysed feedstock. Amongst single layered items, **the large majority have at least one external disruptor to recycling** (zip, button, rivet, buckle, bead, metallic thread, elastic, string, embroidery, flocking, etc.).

The simplest items to recycle (single layered and without any disruptors) represent less than a quarter of the feedstock (22%).

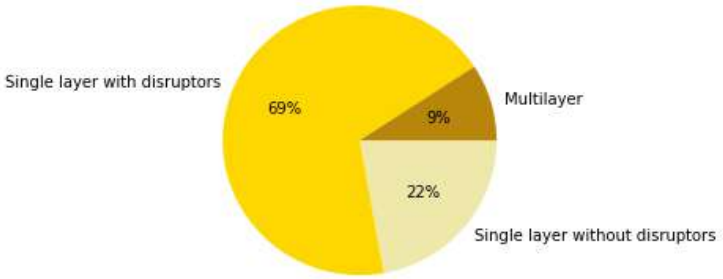


Figure 13: Breakdown of multilayered items or with at least one disruptor to recycling in the analysed stream (in weight)

Colours

Four colours: black, white, blue and grey, account for around 60% of the textiles feedstock.

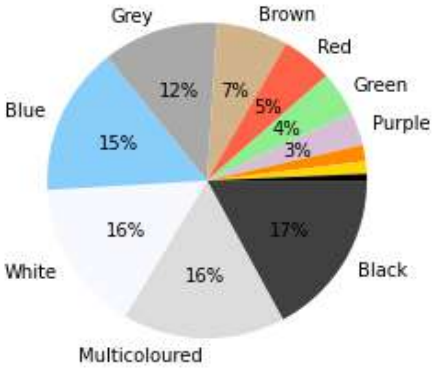


Figure 14: Breakdown of items analysed according to the main colour shades (in weight)

[9] https://refashion.fr/pro/sites/default/files/rapport-etude/Rapport_Etude_des_perturbateurs_et_facilitateurs_au_recyclage_des_textiles_et_linges_de_maison.pdf

Product categories

The details of products corresponding to each simplified category are available in the appendix.

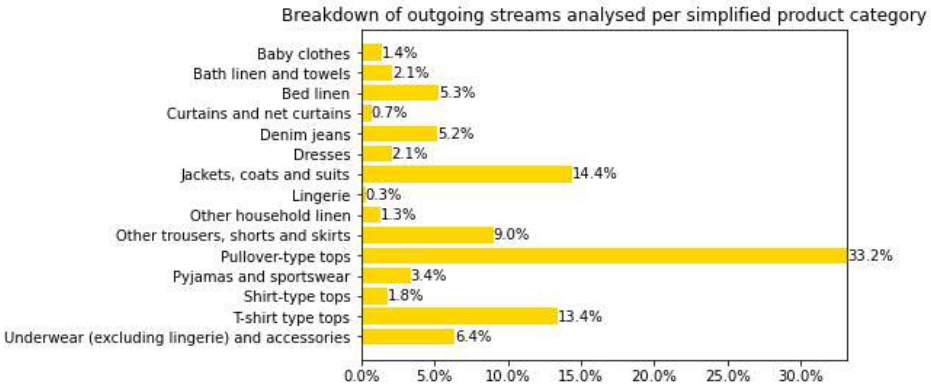


Figure 15: Breakdown of outgoing streams analysed per simplified product category (in weight)

Main compositions

The graph below illustrates the main material compositions in each product category.

A version of this graph with more detailed product categories is available in the appendix.

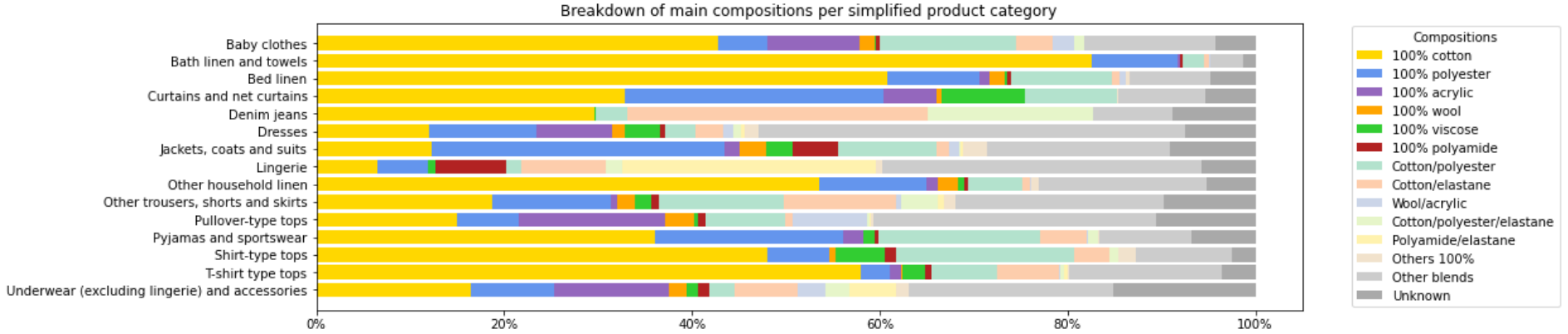


Figure 16: Breakdown of main material compositions per simplified product category (in weight)

Multilayers and disruptors

Similarly, the graph below shows multilayered items or items with external disruptors to recycling.

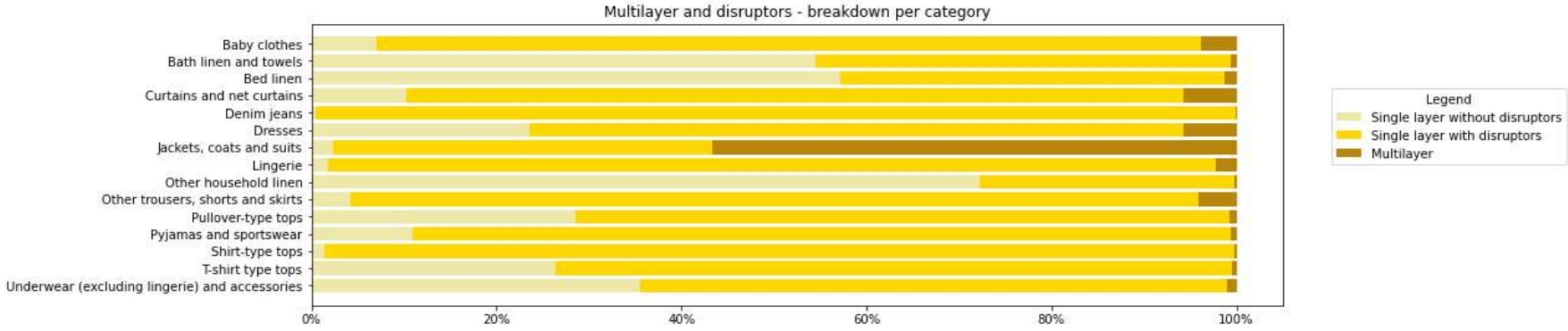


Figure 17: Breakdown of multilayered items and disruptors to recycling per simplified product category (in weight)

Colours The graph below shows the breakdown of colours per simplified product category.

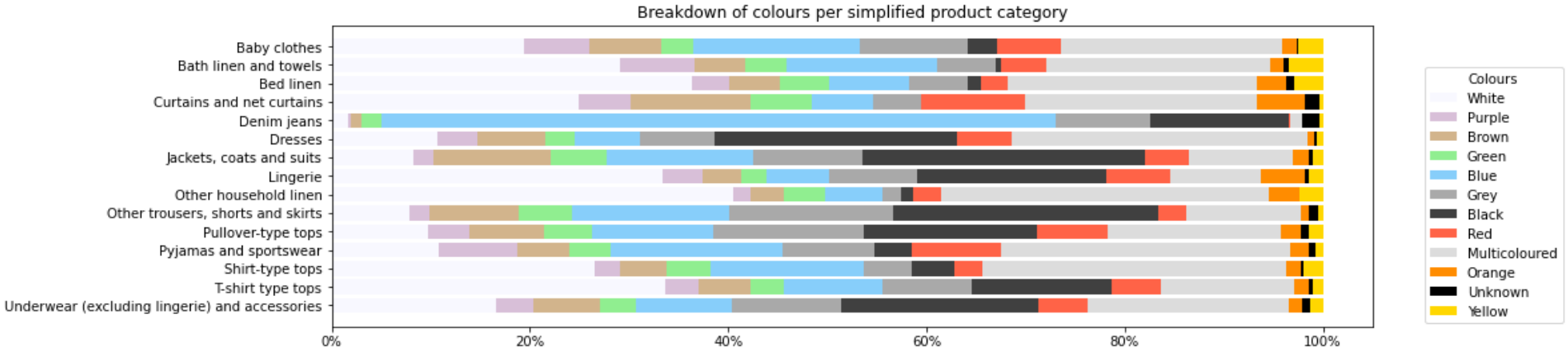


Figure 18: Breakdown of colours per simplified product category (in weight)

Material information sheets

"Material" information sheets have been designed to provide useful information in view to recycling.

For a given material, the following information is indicated:

- the product categories in which this material can mostly be found,
- if these products are more or less difficult to recycle (multilayers, any disruptors to recycling),
- if the material is mostly found pure (100%) or in a blend with other materials.

The information sheets for the two main textile materials are given below: cotton and polyester.

Other "material" information sheets are available here: acrylic, viscose, wool, polyamide, acetate, silk and elastane.

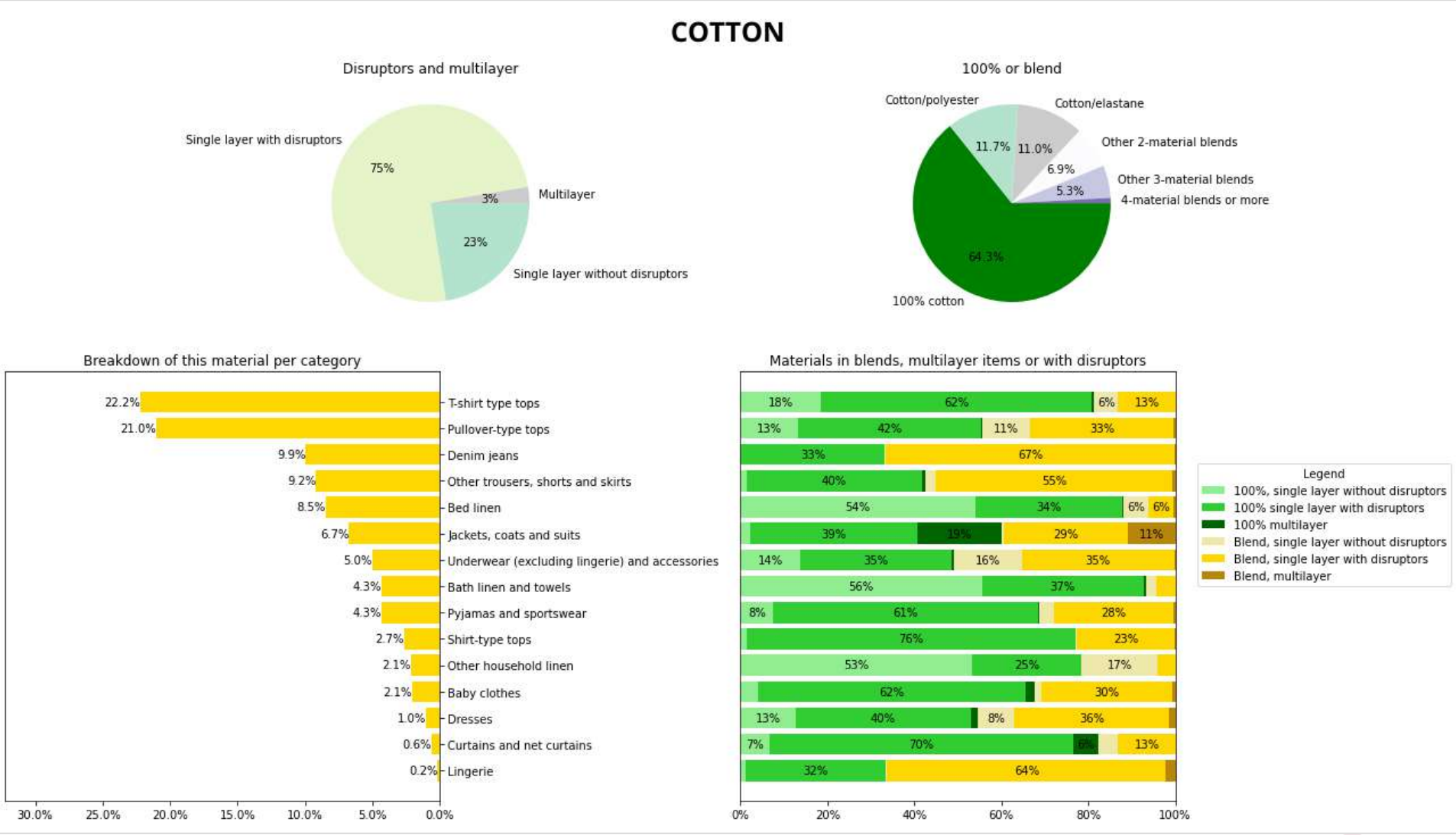
Product information sheets

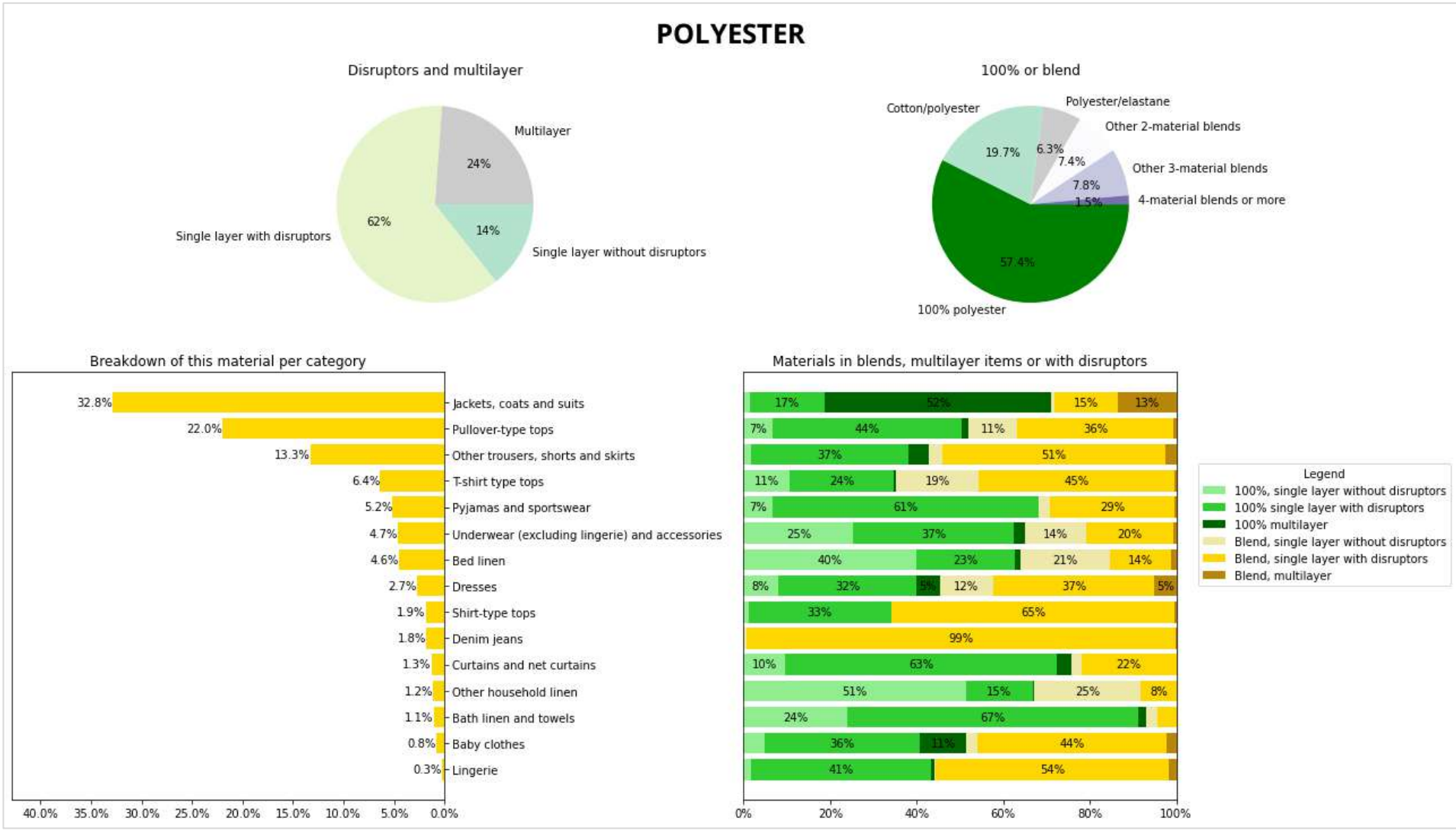
"Product" information sheets have been created on the same principle as the material information sheets.

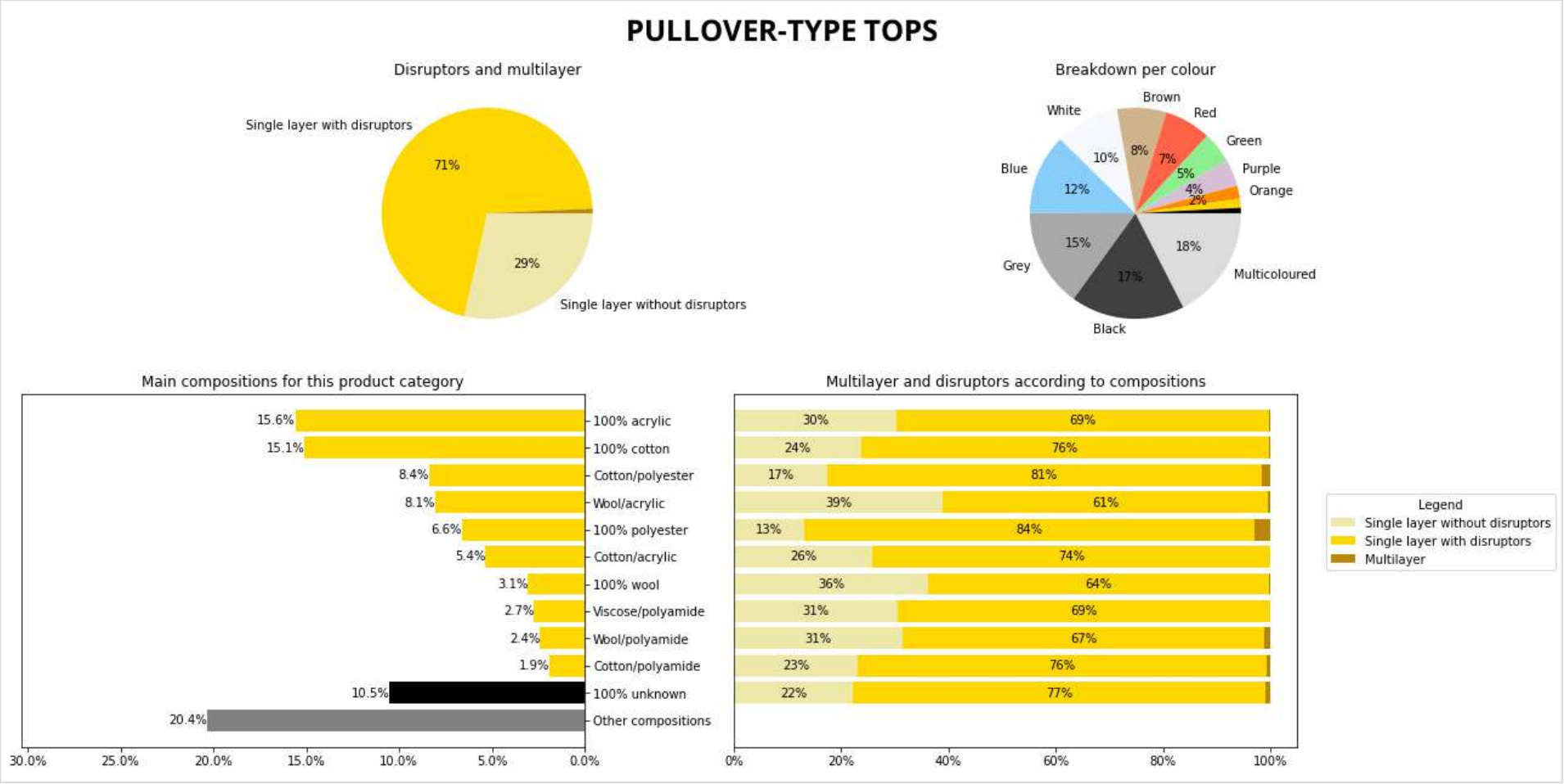
They give information on the different products' material composition and recycling potential.

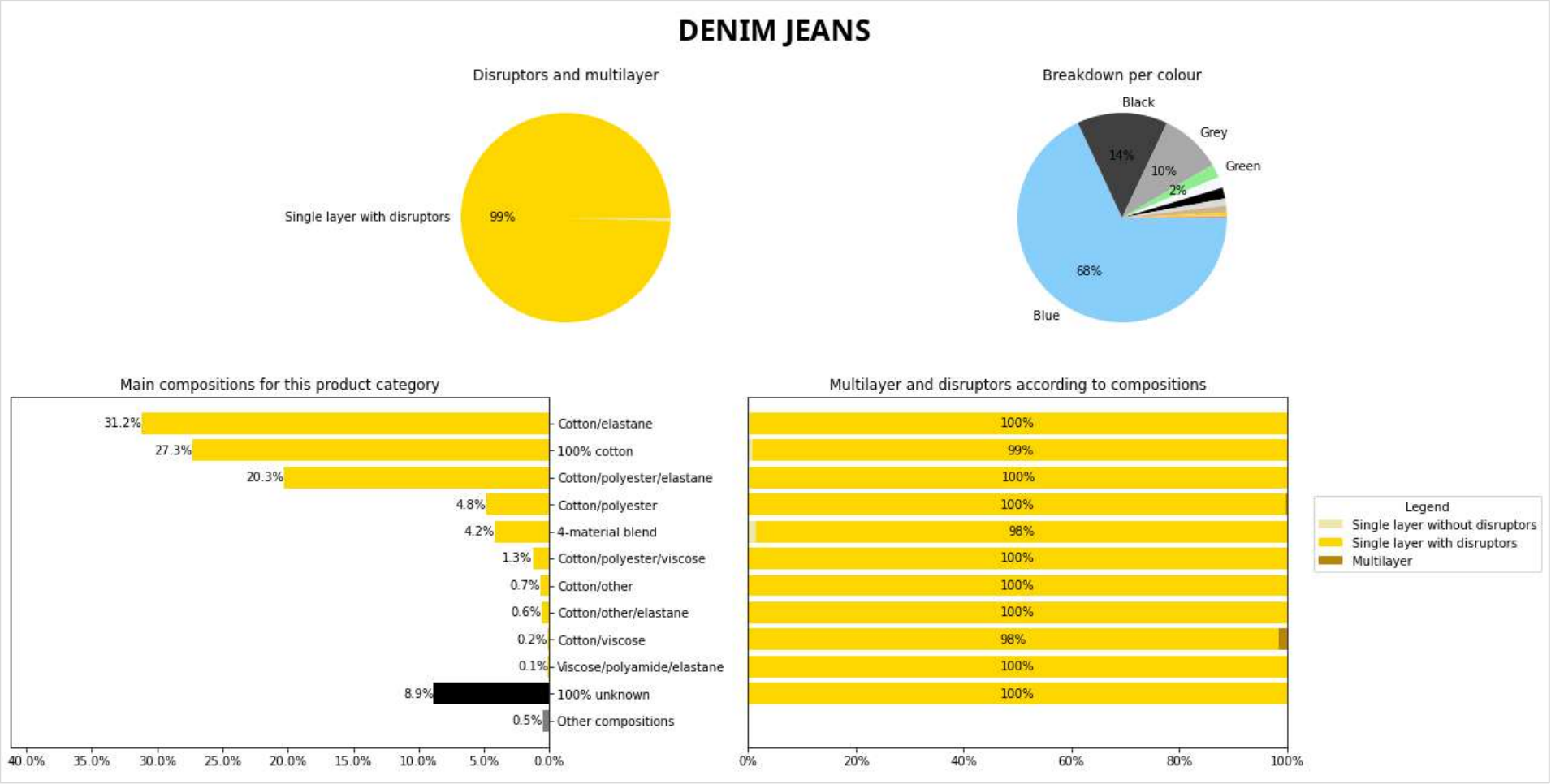
Two examples of product information sheets can be found below: pullover-type tops (knits) and denim jeans.

Other "product" information sheets are available here for all simplified product categories in Figure 15.


COTTON
Disruptors and multilayer
Single layer with disruptors
75%
3%
Multilayer
23%
Single layer without disruptors
100% or blend
Cotton/polyester
Cotton/elastane
11.7%
11.0%
Other 2-material blends
6.9%
Other 3-material blends
5.3%
4-material blends or more
64.3%
100% cotton
Breakdown of this material per category
22.2% T-shirt type tops
21.0% Pullover-type tops
9.9% Denim jeans
9.2% Other trousers, shorts and skirts
8.5% Bed linen
6.7% Jackets, coats and suits
5.0% Underwear (excluding lingerie) and accessories
4.3% Bath linen and towels
4.3% Pyjamas and sportswear
2.7% Shirt-type tops
2.1% Other household linen
2.1% Baby clothes
1.0% Dresses
0.6% Curtains and net curtains
0.2% Lingerie
30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%
Materials in blends, multilayer items or with disruptors
18% 62% 6% 13%
13% 42% 11% 33%
33% 67%
40% 55%
54% 34% 6% 6%
39% 19% 29% 11%
14% 35% 16% 35%
56% 37%
8% 61% 28%
76% 23%
53% 25% 17%
62% 30%
13% 40% 8% 36%
7% 70% 6% 13%
32% 64%
0% 20% 40% 60% 80% 100%
Legend
100%, single layer without disruptors
100% single layer with disruptors
100% multilayer
Blend, single layer without disruptors
Blend, single layer with disruptors
Blend, multilayer


POLYESTER
Disruptors and multilayer
Multilayer
24%
62%
14%
Single layer with disruptors
Single layer without disruptors
100% or blend
Cotton/polyester
Polyester/elastane
Other 2-material blends
19.7%
6.3%
7.4%
Other 3-material blends
7.8%
1.5%
4-material blends or more
57.4%
100% polyester
Breakdown of this material per category
32.8% Jackets, coats and suits
22.0% Pullover-type tops
13.3% Other trousers, shorts and skirts
6.4% T-shirt type tops
5.2% Pyjamas and sportswear
4.7% Underwear (excluding lingerie) and accessories
4.6% Bed linen
2.7% Dresses
1.9% Shirt-type tops
1.8% Denim jeans
1.3% Curtains and net curtains
1.2% Other household linen
1.1% Bath linen and towels
0.8% Baby clothes
0.3% Lingerie
40.0% 35.0% 30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%
Materials in blends, multilayer items or with disruptors
17% 52% 15% 13%
7% 44% 11% 36%
37% 51%
11% 24% 19% 45%
7% 61% 29%
25% 37% 14% 20%
40% 23% 21% 14%
8% 32% 5% 12% 37% 5%
33% 65%
99%
10% 63% 22%
51% 15% 25% 8%
24% 67%
36% 11% 44%
41% 54%
0% 20% 40% 60% 80% 100%
Legend
100%, single layer without disruptors
100% single layer with disruptors
100% multilayer
Blend, single layer without disruptors
Blend, single layer with disruptors
Blend, multilayer


PULLOVER-TYPE TOPS
Disruptors and multilayer
Single layer with disruptors
71%
29%
Single layer without disruptors
Breakdown per colour
White
Brown
Red
Green
Purple
Orange
Blue
Grey
Black
Multicoloured
10%
8%
7%
5%
4%
2%
12%
15%
18%
17%
Main compositions for this product category
15.6% 100% acrylic
15.1% 100% cotton
8.4% Cotton/polyester
8.1% Wool/acrylic
6.6% 100% polyester
5.4% Cotton/acrylic
3.1% 100% wool
2.7% Viscose/polyamide
2.4% Wool/polyamide
1.9% Cotton/polyamide
10.5% 100% unknown
20.4% Other compositions
30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%
Multilayer and disruptors according to compositions
30% 69%
24% 76%
17% 81%
39% 61%
13% 84%
26% 74%
36% 64%
31% 69%
31% 67%
23% 76%
22% 77%
0% 20% 40% 60% 80% 100%
Legend
Single layer without disruptors
Single layer with disruptors
Multilayer


DENIM JEANS
Disruptors and multilayer
Single layer with disruptors
99%
Breakdown per colour
Black
Grey
Green
14%
10%
2%
68%
Blue
Main compositions for this product category
31.2% Cotton/elastane
27.3% 100% cotton
20.3% Cotton/polyester/elastane
4.8% Cotton/polyester
4.2% 4-material blend
1.3% Cotton/polyester/viscose
0.7% Cotton/other
0.6% Cotton/other/elastane
0.2% Cotton/viscose
0.1% Viscose/polyamide/elastane
8.9% 100% unknown
0.5% Other compositions
40.0% 35.0% 30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%
Multilayer and disruptors according to compositions
100% 99% 100% 100% 98% 100% 100% 100% 98% 100% 100%
0% 20% 40% 60% 80% 100%
Legend
Single layer without disruptors
Single layer with disruptors
Multilayer

Comparison with European data

A textile waste characterisation study at European level was published in September 2022 by Fashion for Good[10].

The related report is *"Sorting for Circularity Europe – An evaluation and commercial assessment of textile waste across Europe (SFC Europe)"*.

Background

This European study was carried out between 2021 and 2022 with 8 sorting centres located in 6 European Countries: Germany, Belgium, Spain, The Netherlands, Poland and the United Kingdom.

It was carried out by Circle Economy, with Refashion support for defining the characterisation methodology. This project also used the same spectrometer as deployed in the Refashion characterisation campaign and was therefore able to benefit from the improvements made to the spectrometer by using the Refashion Textile Materials Library.

A methodology that is partly shared...

The initial objective was to compare the results of both studies with the streamlining of a few common methodological points:

- spectrometer used: FabriTell by Matoha,
- identification of disruptors to recycling,
- identification of multilayered items,
- identification of colours,
- common product categories,
- clothing and household linen textile analysis (outgoing streams).

... but with a different scope....

The greatest difference between the two studies concerns the scope of the analysed streams.

The streams covered in each study are indicated in green in the table.

	Refashion	SFC Europe
Mid to high value reused textiles	✗	✗
Low value reused textiles	✗	✓
Recycled textiles	✓	✓
Energy-recovered textiles	✓	✗
Ultimate waste textiles	✓	✗

... and level of accuracy.

Other methodological aspects differ because the Refashion campaign was more in-depth regarding the following:

- systematic identification of compositions given by labels (in addition to spectrometer readings);
- individual weighing of each item;
- continuous work over several months with dedicated analytical personnel;
- systematic sampling of incoming streams;

[10] https://reports.fashionforgood.com/report/sorting-for-circularity-europe/

- a greater quantity of analysed items in relation to the size of the targeted feedstock[11].

Comparison of results

The **differences in methods** highlighted above **do not enable a direct comparison** to be made between results from both studies.

What are the differences in the results?

One of the main **differences** concerns the type of analysed **products**.

The streams in the Refashion characterisation had:

- **more** pullovers and household linen, and
- **fewer** trousers, coats and shirts.

The differences in terms of products are then found in the material compositions and the types of disruptors to recycling.

It can be noted that the results of the **SFC Europe study tend to underestimate the share of blended materials** (SFC Europe's ~32% versus Refashion's ~42%). This observation is probably due to the use of the spectrometer only in the European study (no label reading or adjustment of the data given by the spectrometer as is the case in the Refashion study - see §Methodology for incoming streams, Consolidated material composition).

The same trends observed

Despite these differences, the same main trends and orders of magnitude can be found. They remain similar between the results of both studies, in particular:

- the **preponderance of cotton and polyester**;
- the **significant presence of disruptors to recycling.**

[11] Refashion study: 15 tonnes analysed for a target feedstock of 80 kt* i.e. a ratio of 1 t / 5 300 t (*190 kt sorted x 42.1% excluding reuse - data from 2021 Refashion Activity Report // Europe study: ratio of 1 t / 32 000 tonnes (21 tonnes analysed for a target feedstock of 673 kt - source: *SFC Europe* report).

Appendices

The 2021 Refashion product classification system used during the programme

Cat n°	Category name	Sub-cat n°	Sub-cat name
1	Clothing - Large items	1.1.2	Suits - 2-3 piece Adult women (≥ 15 years)
		1.1.3	Suits - 2-3 piece Adult men (≥ 15 years)
		1.2.2	Sportswear - 2-piece Adult women (≥ 15 years)
		1.2.3	Sportswear - 2-piece Adult men (≥ 15 years)
		1.3.1	Coats Child (4-14 ans)
		1.3.2	Coats Adult women (≥ 15 years)
		1.3.3	Coats Adult men (≥ 15 years)
		1.4.2	Jackets and light jackets Adult women (≥ 15 years)
		1.4.3	Jackets and light jackets Adult men (≥ 15 years)
		1.5	Two-piece work clothing or overalls for private individuals Men-Women-Children
		1.6.1	Padded clothing - multilayer Child (4-14 ans)
		1.6.2	Padded clothing - multilayer Adult women (≥ 15 years)
		1.6.3	Padded clothing - multilayer Adult men (≥ 15 years)
2	Clothing - Medium-sized items	2.1.1	Overalls, overalls with straps (woven fabrics) - including in denim Child (4-14 ans)
		2.1.2	Overalls, overalls with straps (woven fabrics) - including in denim Adult women (≥ 15 years)
		2.1.3	Overalls, overalls with straps (woven fabrics) - including in denim Adult men (≥ 15 years)
		2.2.1	Suits - 2-3 piece Child (4-14 ans)
		2.3.1	Sportswear - 2-piece Child (4-14 ans)
		2.4.2	Pyjamas and other homewear/loungewear - Medium items Adult women (≥ 15 years)
		2.4.1	Pyjamas and other homewear/loungewear - Medium items Adult men (≥ 15 ans)
		2.5.1	Pullover-type tops (knitted) Child (4-14 ans)
		2.5.2	Pullover-type tops (knitted) Adult women (≥ 15 years)
		2.5.3	Pullover- type tops (knitted) Adult men (≥ 15 years)
		2.6	Dressing-up sets and fancy dress Men-Women-Children
		2.7.1	"Sports" trousers and sportswear Child (4-14 ans)
		2.7.2	"Sports" trousers and sportswear - Adult women (≥ 15 years)
		2.7.3	"Sports" trousers and sportswear Adult men (≥ 15 years)
		2.8.1	"Everyday" trousers (woven fabrics) - excl. denims trousers Child (4-14 ans)
		2.8.2	Everyday trousers (woven fabrics) - excl. denims trousers Adult women (≥ 15 years)
		2.8.3	"Everyday" trousers (woven fabrics) - excl. denims trousers Adult men (≥ 15 years)
		2.9.1	Denim trousers Child (4-14 ans)
		2.9.2	Denim trousers Adult women (≥ 15 years)
		2.9.3	Denim trousers Adult men (≥ 15 years)
		2.10.2	Dresses Adult women (≥ 15 years)
		02:11	Fabric sold by the meter Men-Women-Children
		2.12.1	Jackets and light jackets Child (4-14 ans)
		2.13.0	Medium-sized baby clothes (0-3 years) Baby (0-36 months)
		2.14.1	Waterproof clothing Child (4-14 years)
		2.14.2	Waterproof clothing Adult women (≥ 15 years)
		2.14.3	Waterproof clothing Adult men (≥ 15 years)
		02:15	One-piece work clothing for private individuals Men-Women-Children
3	Clothing - small-sized items	3.1	Medium-sized accessories - shawl type Men-Women-Children
		3.2	Hats and headwear derivatives Men-Women-Children
		3.3.1	Pyjamas and other homewear/loungewear - Medium-sized items Child (4-14 ans)
		3.4	High visibility safety vests Men-Women-Children
		3.5.1	Shirt-type tops (woven fabrics) Child (4-14 ans)
		3.5.2	Shirt-type tops (woven fabrics) Adult women (≥ 15 years)
		3.5.3	Shirt-type tops (woven fabrics) Adult men (≥ 15 years)
		3.6.1	T-shirt type tops (fabric in jersey or pique knit) Child (4-14 ans)
		3.6.2	T-shirt type tops (fabric in jersey or pique knit) Adult women (≥ 15 years)
		3.6.3	T-shirt type tops (fabric in jersey or pique knit) Adult men (≥ 15 years)
		3.7.1	Skirts Child (4-14 ans)
		3.7.2	Skirts Adult women (≥ 15 years)
		3.8.1	Pyjamas and other homewear/loungewear - Small items Child (4-14 ans)
		3.8.2	Pyjamas and other homewear/loungewear - Small items Adult women (≥ 15 years)
		3.8.3	Pyjamas and other homewear/loungewear - Small items Men (≥ 15 years)
		3.9.1	Dress Child (4-14 ans)
		3.10.1	Shorts, bermuda shorts - including in denim Child (4-14 ans)
		3.10.2	Shorts, bermuda shorts - including in denim Adult women (≥ 15 years)
		3.10.3	Shorts, bermuda shorts - including in denim Adult men (≥ 15 years)
		3.11.0	Small-sized baby clothes (0-3 years) Baby (0-36 months)
4	Clothing - very small-sized items	4.1	Socks - excl. baby Men-Women-Children
		4.2.0	Socks and underwear Baby (0-3 years) Baby (0-36 months)
		4.3	Gloves, hand muffs, mittens Men-Women-Children
		4.4.2	Lingerie Adult women (≥ 15 years)
		4.5.1	Swimwear Child (4-14 ans)
		4.5.2	Swimwear Adult women (≥ 15 years)
		4.5.3	Swimwear Adult men (≥ 15 years)
		4.6	Small accessories - such as ties Men-Women-Children
		4.7.1	Underwear Child (4-14 ans)
		4.7.2	Underwear Adult women (≥ 15 years)
		4.7.3	Underwear Adult men (≥ 15 years)

5	Household linen - Large items	5.1	Blankets
		5.2	Continental quilt cover
		5.3	Bed linen set
		5.4	Curtains
6	Household linen - Medium-sized items	6.1	Sheets
		6.2	Protective covers
		6.3	Bath linen and mats (humid areas)
		6.4	Bath linen for babies (0-3 years) Baby (0-36 months)
		6.5	Bed linen for babies (0-36 years) Baby (0-36 months)
		6.6	Tablecloths
		6.7	Blinds
		6.8	Fabric sold by the meter
		6.9	Net curtains
7	Household linen - Small-sized items	7.1	Miscellaneous household linen
		7.2	Towels
		7.3	Pillow/bolster cases and protector cases
		7.4	Net curtains
8	Household linen - Very small-sized items	8.1	Miscellaneous table linen
		8.2	Gloves
9	Footwear - Large items	9.1.2	"Boot-type" footwear and others Adult women (Size ≥ 37)
		9.1.3	"Boot-type" footwear and others Adult men (Size ≥ 37)
		9.2.3	"Ankle boot" type footwear and others Adult men (Size ≥ 37)
10	Footwear - Medium-sized items	10.1.1	Flat/low heel footwear Child (sizes 27 to 36)
		10.1.2	Flat/low heel footwear Adult women (Size ≥ 37)
		10.1.3	Flat/low heel footwear Adult men (Size ≥ 37)
		10.2.1	"Trainer" type footwear intended for non-sporting daily use Child (sizes 27 to 36)
		10.2.2	"Trainer" type footwear intended for non-sporting daily use Adult women (Size ≥ 37)
		10.2.3	"Trainer" type footwear intended for non-sporting daily use Adult men (Size ≥ 37)
		10.3.1	"Trainer" type footwear intended for sport Child (sizes 27 to 36)
		10.3.2	"Trainer" type footwear intended for sport Adult women (Size ≥ 37)
		10.3.3	"Trainer" type footwear intended for sport Adult men (Size ≥ 37)
		10.4.1	"Boot-type" footwear and others Children (sizes 27 to 36)
		10.5.1	"Ankle boot"-type footwear Child (sizes 27 to 36)
		10.5.2	"Ankle boot-type" footwear Adult women (Size ≥ 37)
		10.6.1	Summer footwear Child (sizes 27 to 36)
		10.6.2	Summer footwear Adult women (Size ≥ 37)
		10.6.3	Summer footwear Adult men (Size ≥ 37)
11	Footwear - small-sized items	11.1	Indoor footwear Men-Women-Children
12	Footwear - very small-sized items	12.1.0	Baby footwear (0-3 years) Baby (0-3 years)

Cat n°	Category name	Sub-cat n°	Sub-cat name
13	Leather items	13.1	Bags: ladies, girls, evening, men
		13.2	Pocket items: wallet, card holder, purse, keyring, small leather cases, various small leather items.
		13.3	Travel items: suitcase, case, travel bag, vanity case, toilet bag, other travel items
		13.4	Sport bags: rucksack, sport bag
		13.5	Briefcases: briefcases, attaché cases
		13.6	School items: satchel and school bag, pencil case, other school items
		13.7	Items for cats and dogs (collars, leashes, other articles for cats and dogs)
		13.8	Non-fabric belts
		13.9	Other items in leather
14	Professional clothing	14.1	Professional clothing
15	Toys (non-electrical)	15.1	Toys (non-electrical)
16	Books	16.1	Books
17	WEEE	17.1	WEEE
18	Trinkets, utensils	18.1	Trinkets, utensils
19	Packaging	19.1	Packaging
20	Fabric bags	20.1	Fabric bags
21	Cushions, duvets, pillows	21.1	Cushions, duvets, pillows
22	Furnishing fabric by the meter	22.1	Net curtains
		22.2	Curtains
23	Mats	23.1	Mats
24	Others	24.1	Others (organic waste, coat hangers, balls of wool, etc.)
25	Fabric off-cuts	25.1	Fabric off-cuts

The simplified product categories

Simplified product category	Examples of products included in the category
Clothing	
Pullover-type tops	Pullover-type tops (knits)
T-shirt type tops	T-shirt type tops
Shirt-type tops	Shirt-type tops
Pyjamas and sportswear	Pyjamas and other homewear/loungewear Sportswear
Denim jeans	Denim jeans
Other trousers, shorts and skirts	"Every day" trousers - excl. denim "Sport" trousers and sportswear Bermuda shorts - including denim ones Skirts Overalls - dungarees - including denim ones
Dresses	Dresses
Jackets, coats and suits	Suits Jackets and light jackets Coats Padded jackets Waterproof clothing Work clothing for private individuals High visibility safety vests Dressing-up sets and fancy dress
Baby clothes	Baby clothes
Underwear (excluding lingerie) and accessories	Underwear Footwear Swimwear Small accessories (such as ties) Gloves, hand muffs, mittens Hats and other headgear in textile Medium-sized accessories (shawl type) Clothing fabric by the meter
Lingerie	Lingerie
Household linen	
Bed linen	Blankets Sheets Pillow/bolster cases Protective covers Continental quilt cover Bed linen set
Bath linen and towels	Towels Bath linen and mats (humid areas)
Other household linen	Tablecloths Blinds Miscellaneous household linen Miscellaneous table linen Oven gloves Furnishing fabric by the meter
Curtains and net curtains	Curtains Net curtains
Footwear	
"Boot", "ankle boot" type footwear and others	"Ankle boot" type footwear "Boot-type" footwear and others
Flat/low heel footwear	Flat/low heel footwear
Footwear such as "trainers"	"Trainer" type footwear intended for sport or daily non-sporting use
Summer footwear	Summer footwear
Indoor footwear	Indoor footwear

Baby footwear	Baby footwear
Non-CHF	
Non-CHF	Bags Sport bags Pocket items (wallet, purse, small leather items, etc.) Briefcases School items (satchels, pencil cases, etc.) Items for cats and dogs (collars, leashes, etc.) Non-textile belts Other items in leather Professional clothing Toys (non-electrical) WEEE Books Trinkets, utensils Packaging Fabric bags Cushions, duvets, pillows Mats Fabric off-cuts Others (organic waste, coat hangers, balls of wool, etc.)

Main material compositions per detailed product category

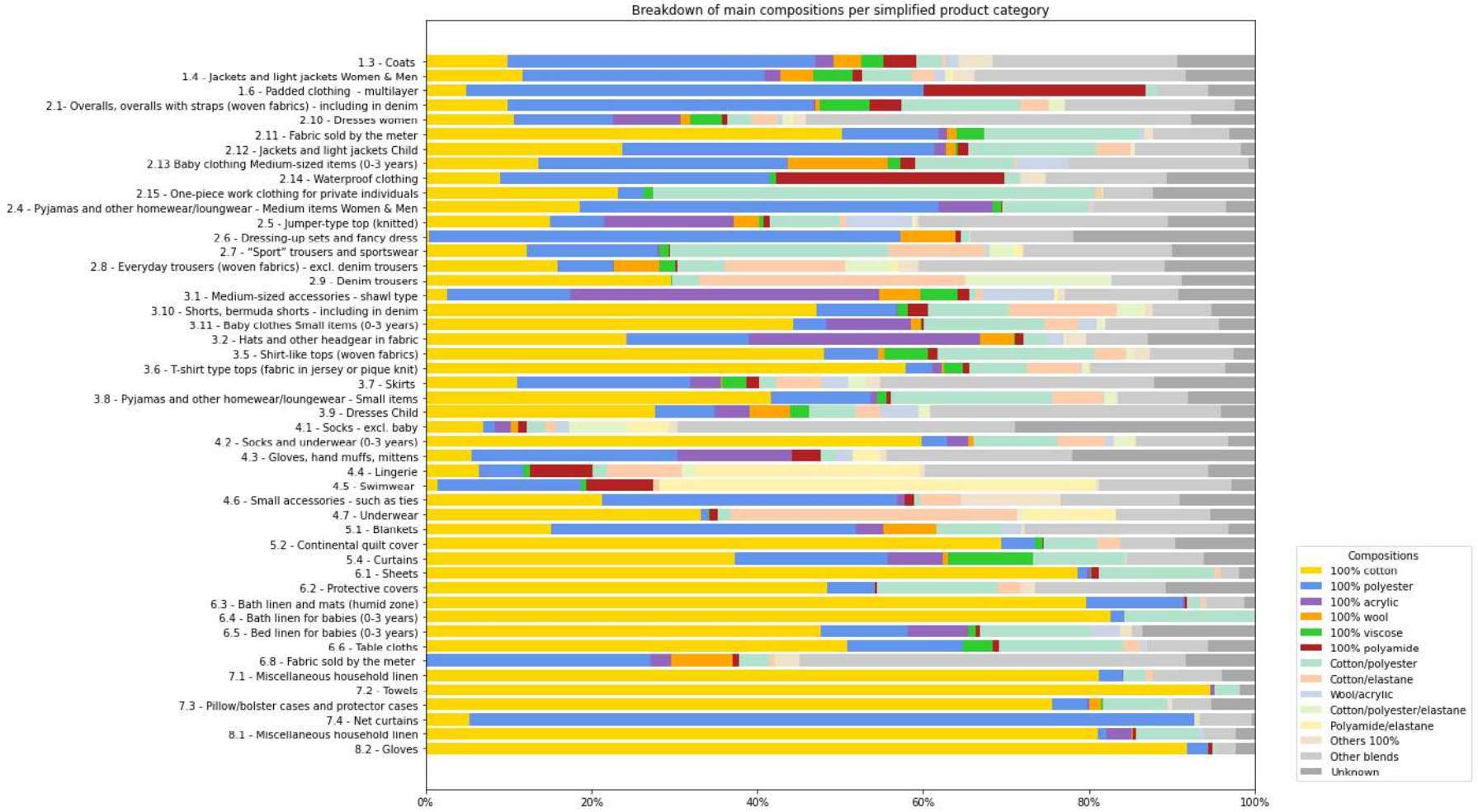


Figure 19: Breakdown of main material compositions per detailed product category (in weight)

Only the product categories in which at least 50 items were analysed are shown.

Details on collected data during the analysis of outgoing streams

Multilayer

Designates a textile item that is made up of several distinct layers, with each one possibly containing different materials.

Only items with two layers accounting for at least 1/3 of the surface area of an item have been classified as "multilayer".

Multilayered items data has been collected for both main layers (material composition, colour, etc.).

Multilayer	Single layer		
			
2 layers	1 layer	1 layer + textile disruptor to recycling	1 layer + textile disruptor to recycling

Material composition

Material composition was systematically recorded in two ways:

- reading of the label if it was present and legible,
- detection using an infrared spectrometer (FabriTell by Matoha).

Weight

Individual weighing of each item. The multilayered items weight is arbitrarily broken down at 50/50 between the two layers.

Colours

Dominant colour identified by the analytical operator:

- black
- grey
- blue
- brown
- green
- orange
- purple
- red (including pink)
- white
- yellow
- multicoloured

Disruptors to recycling

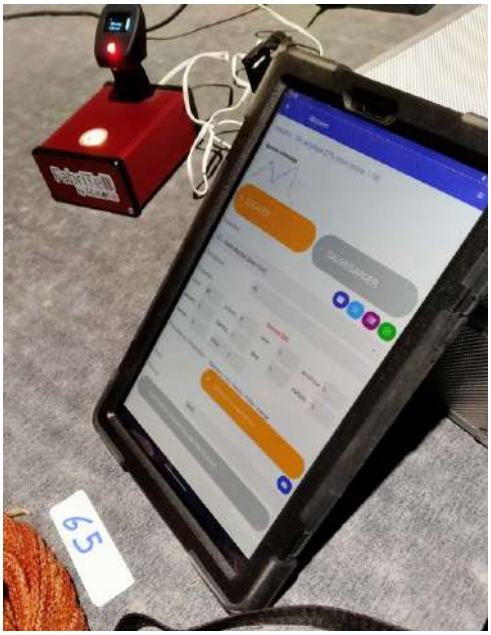
The presence of hard points or any other external disruptors to recycling was captured for each item using the following categorisation system:

	Description	Examples
None	No disruptor	-
Metal	Only metal disruptors	Zip, button, rivet, hook, buckle, eyelet, Lurex thread, etc.
Plastic	Only plastic disruptors	Button, reflecting high-visibility band, zip, bead, foam, buckle, etc.
Textile	Only textile disruptors	Elastic, string, ribbon, embroidery, pocketing fabric, insert, yoke, pompom, etc.
Other (1st case)	Only disruptors in another material	Leather, fur, flocking, wood, etc.
Other (2nd case)	Several disruptors in different materials	Elastic + plastic button; plastic zip + metal button; etc.

Illustrative photographs

Pre-sorted streams provided by the sorting centres

Incoming streams: Sorting bins following the Refashion product classification system



Outgoing streams: workstation including spectrometer, tablet and scale

Analysed streams before redispatch to the partner sorting centres