RECUPRENDA
VÍA VERDE PARA TU ROPA

In-Cycle
Keeping materials in production cycles

AIR COOP
COOPÉRATIVE D'ENTREPRENEUR·E·S DU CHANGEMENT

With the support of: Re_fashion

TEXTILE ECO DESIGN GUIDELINES TO IMPROVE RECYCLABILITY

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1. CONTEXT & OBJECTIVES

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Used clothing is often sorted for reuse at the end of life, furthermore, it is also possible to repair or 'revive' lightly damaged garments to extend their life. For clothing that cannot be reused or revived, there are a number of different recycling routes available; mechanical recycling, such as fibre to fibre (Filatures du Parc, Hilaturas Ferre), or chemical based recycling technologies, such (Re:newcell, Resyntex and Worn-again). However, it is argued that, for all these technologies to work efficiently, the textiles need to be 'prepared for recycling', meaning the textile must be sorted (e.g. into material types) and metals and hard plastic parts must be removed as these parts can cause problems for downstream processing technologies. In the Revive and Recycling project (funded by ReFashion), Recrupenda (Spain), In-Cylce (UK) and AIR (France) have developed a unique clothing revival process and a 'prepare for recycling' technology solution. **The ambition of the document, is thus to present practical 'design for recycling' guidelines based on our experience of 3 years with running a textile revive and recycling pilot line in Valencia.**

A number of brands and organisations have developed sustainability index (for Example WRAP UK and HIGG index)however**, there is no clear guidelines currently available for textile designers or brands to improve the recyclability of textile clothing waste.**

N.B. This is the first edition of these guidelines. We aim at improving it over the years. Thus, do not hesitate to share your feedback and suggestions to make it better and help the footwear industry to reduce its impact on the planet.

2. MAJORS CHALLENGES

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Here is the list of the major challenges we are currently facing at the textile recycling line :

1. **Metal** pieces contamination in the output
2. **Solid plastic** pieces contamination in the output
3. **Multilayer clothing** used in the textile industry
4. **Materials identification** at the end of their first use
5. Contamination with **electronic components**
6. Contamination with **non compliance chemicals** (ex. PAH)
7. **Logos and branding** preventing revival
8. **No spare parts** preventing revival

2. MAJOR CHALLENGES

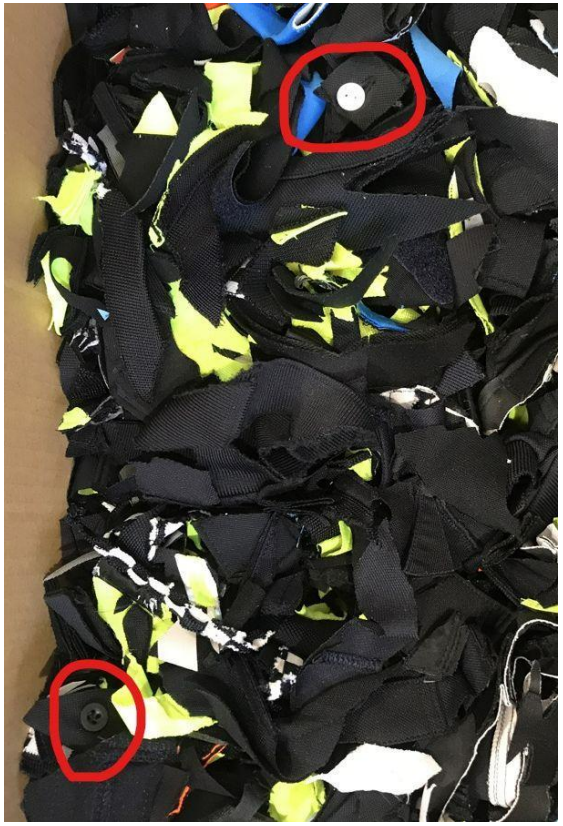
1. Metal pieces contamination in the output

Even though the system has been specifically designed to separate metal parts from textiles and a ‘detect and eject’ metal separation machine is installed that is able to successfully remove small metal pieces, (e.g. small pieces of brass metal zipper), there is still a small risk of some metal contamination of the recycled output. Furthermore, good textile is also rejected alongside the small metal pieces, meaning the overall yield of good material is reduced.

2. MAJOR CHALLENGES

2. Solid plastic pieces contamination in the output

Certain clothes, like men's shirts have a relatively high percentage of small hard plastic parts, like plastic buttons. With these clothes there is a small change that not all hard plastic will not be completely removed from the textiles. For example, a button can be attached to a large and light piece of textile (acts like a sail) and ends up in the clean material fraction. These hard points can present a problem for downstream material recycling (fibre pulling and spinning) or chemical recycling if the plastic type is different from the target textile.



2. MAJOR CHALLENGES

3. Multilayer clothing used in the textile industry

Certain clothing products are a complex mixture of multilayer materials. This somewhat prevents separation of textiles into mono materials (i.e. polyester, cotton, nylon, wool, etc). Furthermore, when shredded, these layers can still be stuck together and thus cannot be fully separated.

2. MAJOR CHALLENGES

4. Materials identification at the end of their first use

At end of life, it is often difficult to manually sort and recognise the textile material type, as either the label is missing or is unclear. Furthermore it can be time consuming to manually sort through clothing by reading the labels. To aid this task an NIR scanner can be used. However, identification of certain blends can still be a challenge.

2. MAJOR CHALLENGES

5. Contamination with electronic components

The use of electronics in textiles was not an issue 10 years ago. But now the trend is increasing. For example, led lights can be integrated into a jumper (Christmas jumper) or wearable sports technology sensors. Of course, due to the electronic components, these products need another type of sorting/recycling and currently can not be recycled through the Revive/Recycle line.

2. MAJOR CHALLENGES

6. Contamination with non compliance chemicals

Collecting and sorting any kind of textiles in Europe can be problematic when it come to chemical compliance. Indeed, some of the textiles collected are originated from diverse countries and years old production. Some of the clothes collected have potentially more than 20 years of existence, way before chemical regulation like REACH were in place.

2. MAJOR CHALLENGES

7. Logos and branding preventing revival

Certain brands do not wish for there logo/branding to be present on the textiles after it has been repaired and/or can prevent their reuse. Moreover, there are also legal issues around certain logo/lettering on the textile (for example police logo), which prevents it from being revived for a second life.

2. MAJOR CHALLENGES

8. No spare parts preventing revival

If a textile item has a specific type of button or zipper, if can be difficult to find a suitable replacement during the revival process. Or it may be difficult to find a suitable piece of material (patch) to repair a minor tear.

3. OUR RECOMMANDATIONS

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Based on our experiences with the pilot line which can recycle over 1 ton of textile waste per day, we have been able to define some key recommendations to improve recyclability:

1. **Reduce the use of metallic parts**. Only use metal parts for functional parts of the textiles and avoid using for cosmetic reasons.
2. **Limit the use of solid plastic pieces.** Or use the **same material as the textile** if possible.
3. **Limit the use of multilayer materials or use same/compatible materials.**
4. **Consider the material blends** for NIR separation.
5. **Avoid non removable electronics components.**
6. **Include spare parts for repair.**
7. **Design branding to be easily removed.**

N.B. Of course, before designing apparel to improve recyclability, apparel should be designed to be repaired and last as long as possible.

3. RECOMMANDATIONS

1. Reduce the use of metallic parts

For certain clothing it is necessary to use metal parts for functional reasons. For example, metal buttons and zippers for jeans. However, some clothing uses metal parts for aesthetic purposes. In general, the more metal that is used in the clothing, the higher the change of a small piece of metal ending up in the clean material fraction. Thus, it is recommended that metal is only used where absolutely necessary or strictly limited to certain regions of the clothing and not distributed across the whole textile piece. This would also add the process of manual removal (cutting off) if the clothing were to be recycled in a country with lower manual labour (e.g Demin recycling in Indian).

3. RECOMMANDATIONS

2. Limit the use of solid plastic pieces

For certain clothing it is necessary to use plastic parts for functional reasons. For example, buttons and zippers. However, some clothing use plastic parts for aesthetic purposes (e.g logos/branding). In general, the more plastic that is used in the clothing, the higher the change of a plastic piece ending up in the clean material fraction. Thus, it is recommend that hard plastic is only used where absolutely necessary or strictly limited to certain regions of the clothing and not distributed across the whole textile piece.

Furthermore if hard plastic is used it should be chosen to match the host textile material to help improve the feasibility of chemical recycling. For example, if a polyester textile fabric, then a PET button should be chosen.

3. RECOMMANDATIONS

3. Limit the use of multilayer materials or use same/compatible materials.

Clothing that contains a complex multilayer construction prevents separation of textiles into mono materials. Future clothing should be designed to reduce the number of different material present within the product. For example a outdoor jacket could be complexly made of polyester, using different grades for different functional parts (see drawing). Or designing the clothing to have removable/ detachable inner layers that can be separated during recycling.

3. RECOMMANDATIONS

4. Consider the material blends for NIR separation.

Certain blends can be difficult to detect with NIR scanner, for example, three or more blended textiles (e.g. cotton, polyester and nylon). As there is number of companies producing NIR scanning technology for textile identification, if would be useful for them to highlight which blends are problematic for NIR identification. A list can then be published and added to the ‘design for recycling guidelines to help avoid the use of these problem blends where possible.

3. RECOMMANDATIONS

5. Avoid non removable electronics components

Electronic components can contain hazardous components that need specialized recycling technology.
One simple solution is to make these electronics integrated into a small module (installed inside a small inside pocket) that can be easily removed by the consumer prior to disposal. However, currently, some electronics (LEDs) tends to be fully embedded into the textile fabric which will present many problems for future textile recycling.

3. RECOMMANDATIONS

6. Include spare parts for repair

To add the repair/ revival process clothing should be sold with repair accessories attached to the clothing, much like some clothes already include a spare button.

Furthermore, if possible standard type of buttons, zippers, etc., should be used to improve the repairability.

3. RECOMMANDATIONS

7. Design branding to be easily removed.

Since certain logos/branding and lettering prevent the clothing being revived or reused, these parts of the textiles should be designed to be easily removed. For example a police lettering could be designed using a modular Velcro construction. Or the logo should be designed to be easily cut off without damaging the textiles.

4. RESOURCES

Brands considering textiles recyclability:

- Pepe Jeans.
- Hackett.
- Millet/Lafuma.
- OVS.
- BIMBA Y LOLA.
- Ternua.
- Hedoïne.
- Mo.
- Zippy.
- Decathlon.
- Loewe.
- Marc O'Polo
- Burberry.
- Holzweiler.
- H&M.
- TENDAM Group.

R&D institutions developing recyclability solutions:

- AITEX.
- AIMPLAS.

Yarn and fabric producers that contribute to clothes recyclability:

- Unifi (polyester).
- Vilarrassa (cotton).
- Recover (cotton).
- Antex (polyester).

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