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ELASTANE FIBERS IN TEXTILE RECYCLING – ANALYZING THE PRODUCT GROUP T-SHIRTSREVIEW

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Elastane Fibers in Textile Recycling – Analyzing the Product Group T-Shirts

BY

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ABSTRACT

Garments are made of a large variety of different materials, from blended fibers to haberdashery items and colorants or finishings, making it difficult if not impossible to predict the composition of the post-consumer textile waste stream. This mix of materials complicates recycling efforts, contributing to less than 1 % of fiber-to-fiber (F2F) recycled fibers globally. To strengthen the industry's efforts towards a more sustainable and circular textile industry, we must focus, among other things, on design for recycling and thus address the current challenges of the F2F recycling technologies.

Most garments are made from fiber blends, typically containing two or more different fibers. While beneficial for comfort and durability, fiber blends pose a significant obstacle for high quality F2F recycling. Especially the fiber elastane, though usually only present in small quantities, is a great challenge; from the detection of the fiber up to the removal and recycling of it. In a previous study, we looked at common haberdashery items on T-shirts. The following study focuses on elastane contents in T-shirts, considering the fit of the garment of several brands. The results will help to understand the product group T-shirts better and allow us to formulate ecodesign guidelines based on the current market status quo. The ecodesign guidelines will enable the garment producers to make better choices during material selection regarding design for recycling and will help shift the industry towards a circular economy.

Keywords: Circularity, Contaminants, Ecodesign, Elastane, Sustainability, Textile Recycling

1. INTRODUCTION

For the past decades, the production of virgin fibers is steadily increasing, estimated to reach a new high with 160 million tons of annual fiber production by 2030. (Textile Exchange 2024) This is linked to the growing global population and the rising demands for new clothing due to the affordable mass production fashion. Consumers in high income countries expect new garments in the stores almost weekly, usually not thinking about the environmental impacts of textile and clothing production, trading and waste. To further satisfy consumer demands but reduce the negative impacts fiber production has on the environment, Fiber to Fiber (F2F) Recycling is expected to be part of the solution. Currently, only about 8 % of the fibers produced worldwide are recycled fibers, of which under 1 % originate from pre- and post-consumer textile waste (Textile Exchange 2024).

While the European Union aims to improve F2F Recycling efforts in the industry and implement a minimum content value of recycled fibers for new garments by 2030 (European Commission 2022), the cost of recycled fibers is still too high compared to virgin fibers (Uyanik and Seval 2020). Due to several challenges which inhibit the upscaling of available

recycling technologies, the processes are yet to become economical and ecologically viable in large scale.

One of the main challenges for viable F2F recycling processes are fiber blends. The blending of fibers is done for various reasons, mainly to improve the comfort of the garments as well as to save costs. To date, there are no regulations or guidelines for the blending of fibers, making it hard to predict the composition of textiles. As the fabric composition is one of the main information needed for high quality F2F recycling, regulation of blends in form of e.g. mandatory ecodesign guidelines would improve the overall productivity and quality of F2F recycling efforts.

The following study focuses on elastane fibers present in the product group T-shirts. Elastane fibers are hard to detect both by hand and technologies like Near Infra-Red (NIR) Spectroscopy, as they are usually only present in small quantities and often deeply imbedded in the yarns, making it one of the most challenging fibers in blends.

This study is based on a previous study published, titled "Contaminants In Textile Recycling – A Look At Common Haberdashery And Fiber Blends Found In T-Shirts" from the year 2024 (Behrendt and Eppinger 2024). To gain further insights in the product group T-shirts, the following study will focus on elastane fibers as well as the fit of the garments, allowing us to draw further conclusions about the composition of T-shirts as well as formulating more specific ecodesign guidelines regarding the elastane content values for fiber blends used for the production of T-shirts. These conclusions will help to close the loop within the textile industry, as they enable us to better predict the overall contents of this specific product group, making it a more interesting input stream for recycling companies.

2. LITERATURE REVIEW

Below, we will briefly explain the available recycling technologies and their challenges, as well as the importance of the product group T-shirts, using results from the previous study. Furthermore, we will shortly talk about elastane fibers.

2.1. T-Shirts

T-shirts are some of the most popular types of garments, widely worn by all genders, making them a staple in every wardrobe around the world. Due to their popularity, T-shirts are also present in the used garment collection bins in large numbers, making them an interesting product type for recycling companies.

T-shirts are usually made from knitted cotton fabrics, though in recent years, fiber blends like polycotton are often utilized as well, reducing the production costs of the garments. T-shirts can be made from a variety of different fibers and are not limited to having cotton fiber contents. Another fiber type that is often present and blended with cotton fibers are elastane fibers. Depending on the fit of the T-shirt, differentiating values of elastane fibers are added to the main fiber to ensure proper fit and comfort during wear, increase form stability also after laundry and decrease the need for ironing (Eryuruk and Kalaoglu 2016). The structure of knitted fabrics itself already allows some degree of stretchability, though depending on the utilized fibers might not be very dimensionally stable for longer periods of wear and wash cycles (Power 2015; Eryuruk and Kalaoglu 20). The blending with elastane fibers allows the fabric structures to relax back into their original shape for longer, enhancing both the comfort and the lifecycle of the garment.

While there are a huge number of adornments possible, most T-shirts are either plain or with a print. Fasteners like buttons or zippers are usually not necessary, but can be added for design purposes. Additional haberdashery items that can be present on T-shirts include pearls and sequins, ribbons and embroidery. Results from our previous study, where we analyzed 618 T-shirts have shown that the most common haberdashery items or contaminants are big prints (119 pcs), patches, embroideries or small prints (26 pcs) and buttons/snap buttons (total 37 pcs). Around 67 % (416 pcs) of all garments did not have any haberdashery items added. (Behrendt and Eppinger 2024)

2.2. Elastane Fibers

Elastane is a widely known and used fiber in the textile industry. Despite its wide application, it only made up 1.1 % of the world fiber production in the year 2023 (Textile Exchange 2024). This can be explained with the relatively low content values of which this fiber is added to fiber blends. The percentage of elastane in textiles varies depending on the type of fabric and its intended use. In cotton or wool fabrics, the content value of elastane is usually only one to five percent, in polyester or polyamide

textiles, the content value can be up to twenty percent (Boschmeier et al. 2022). Elastane fibers are particularly characterized by their high elasticity and an elongation at break of over 200 % (Senthilkumar et al. 2011). This enables textiles with elastane to return to their original shape after stretching, making them ideal for tight fitting yet comfortable garments. Elastane fibers are usually well ingrained in the fabrics, most often used as a core in core-spun yarns. This makes a detection both by hand and via technology like NIR Spectroscopy challenging.

2.3. Recycling Technologies

There are several textile recycling technologies available, which can be differentiated into five main categories. The process of each technology will be explained shortly below, showcasing both their challenges and suitability for the product group T-shirts.

The best known and widely available recycling technology is **mechanical recycling**. This technology does not rely on chemicals, but utilizes mechanical force for fiber separation instead. The garments are first cut into smaller squares and are then shredded by turning spiked drums. The spikes tear the fabric scraps apart until only the fibers remain. This is imposing high mechanical stress on the fibers, resulting in weakening and breaking of the fibers and thus ultimately reducing their quality. To reintroduce the fibers into a spinning process, they require blending with virgin fibers to ensure spinnability. (Ribul et al. 2021) Challenges of T-shirts for mechanical recycling processes are high elastane contents, coatings like big prints and small metal parts. Fiber blends pose no problem for mechanical recycling, though depending on the wanted output and further use of the regained fibers might want to be monitored nevertheless. This recycling process is a downcycling process. T-shirts are suitable as input.

The next in line is **thermo-mechanical recycling**. This process is only suitable for thermoplastic polymer fibers such as polyester or polyamide. Cut-up fabric scraps are heated up in a screw extruder and pressed into polymer pellets which can be used for a variety of different applications, including the production of new fibers (Park and Kim 2014; Pensupa 2020). This process requires high purity materials as input, as contamination will threaten the integrity of future fibers (Ribul et al.,2021; Lee and Liew 2021). This process is mainly used for bottle-to-fiber recycling, as PET bottles are a heterogenous waste stream with limited impurities (Sarioğlu and Kaynak 2018). Garments could be recycled this way, though only if made from a suitable mono-material. T-shirts without any contaminants and made of the respective polymer fibers could be recycled this way. The application is generally limited for textile recycling.

The third recycling technology is **solvent-based recycling**. Specific solvents are used to selectively dissolve the targeted fibers. The dissolved fibers will then be filtered and can be regenerated while the remaining fibers stay mostly unaffected by this process and can be further processed or used as is. The quality of the dissolved polymers stays the same, further steps to improve it are possible. This process is especially useful for fiber blends. (Pensupa 2020; Ribul et al. 2021; Wang and Salmon 2022) Contaminants such as metal parts and other large haberdashery items should be removed beforehand. Pretreatment steps like color removal can be beneficial, as colorants and additives could also disrupt the processes. (Palme et al. 2017; Pensupa 2020) T-shirts are suitable as input.

Chemical monomer recycling is one of the most promising F2F recycling technologies in terms of quality of the recovered fibers. With this technology, the fibers are broken down to their monomers by depolymerization. The depolymerization can be conducted by different methods, e.g. methanolysis, hydrolysis or glycolysis. Each method allows a different amount of contaminants present in the input. The process is only viable for synthetic polymer fibers as the depolymerization of cellulose to glucose is irreversible. The monomers gained in this recycling process are of virgin quality and can be used in a variety of different applications, including the production of e.g. polyesters for fiber production. (Pensupa 2020; Roos et al. 2019) Depending on the depolymerization method used, different contaminant-thresholds are possible (Park and Kim 2014; Lee and Liew 2021). Metal parts should be removed before this process. Further pretreatment steps can be beneficial. T-shirts made from mostly synthetic fibers are suitable as input.

The last in line is **biological recycling**. This technique is still rather new and mostly conducted on lab-scale. Here, the depolymerization processes are executed by natural means such as by enzymes or microorganisms, hence the name biological recycling. Enzymes selectively break down the polymers, resulting in a

mixture of unprocessed fibers and monomers or oligomers. The regained monomers are of virgin quality and can be used as described earlier. Due to the selectiveness of the enzymes, processing of fiber blends is possible. (Ribul et al. 2021; Lee and Liew 2021). As enzymes and microorganisms can be vulnerable to environmental changes such as temperature as well as contaminants such as additives or colorants, the amount of contaminants in the input should be as low as possible and the parameters of the process should be strictly supervised (Chanda 2021). T-shirts are suitable as input.

To summarize, all recycling technologies have their own specific requirements regarding the input. T-shirts would technically be suitable as input for all of them, depending on their material composition. As a general rule, it is safe to say that the least amount of contaminants that are present and the better the material composition is disclosed beforehand, the better the processes can be conducted, increasing the quality of the output as well as the economic and ecological viability. All the processes require a steady amount and quality of input to run smoothly, which is currently a major issue. Advancements in automated material sorting and detection plus removal of contaminants will be hugely beneficial for F2F recycling.

3. METHODOLOGY

In accordance with the previous study, we will be analyzing the same two brands in this study. The two brands had been selected randomly from the statistic "The giants of large-scale distribution" from the Modaes.es (2023) report titled "El Mapa de la Moda 2023 Facts & Figures". The random selection resulted in the brands H&M and Primark, which are 2nd and 6th in the popularity ranking.

In this study, the focus will be on elastane fibers. We will not only look at the elastane content values and fiber blends, but also take the fit of the garments into consideration. Other contaminants such as haberdashery items and prints are not taken into consideration in this study.

To determine the content value of elastane fibers as well as the primary fibers used in fiber blends utilized in the product group T-shirts, the currently available garments of said product group by each brand were analyzed. For data collection, the German versions of both online shops have been observed in early March 2025 (CW 10). To reduce the amount of search results, the listed garments have been filtered further using the available filter-options of each online shop. The utilized filters can be seen in Table 1. The results from the search may include the individual listing of each available colorway of a garment as well as duplicated listings of the same garment. Few garments have been listed several times in the H&M online shop, resulting in 285 T-shirts documented instead of the 281 initial search results.

Table 1. Applied search criteria for analyzed garments for the category T-shirts

Brand	Main Category	Additional Filters	No. of total Results	Notes
H&M	Women Clothes Tops & T-Shirts	Product type: T-Shirts Brand: H&M	281 (03.03.2025)	Includes long sleeves
Primark	Women Clothes Tops & T-Shirts	Product type: T-Shirts	234 (03.03.2025)	Includes tops, vests, long sleeves and bodies

The garments matching the applied filter options are analyzed by the following criteria: (a) Material Composition, (b) Fit, (c) Sportswear or Standard Garment. In accordance with our previous study, we differentiate between a total of 17 possible fiber types. For the fit of the garment, we differentiate between five different options: (1) Bodycon, (2) Tight, (3) Normal, (4) Loose, (5) Oversized. The assignment of the fit category is of course a subjective matter. In order to keep the margin of error as small as possible, one person carried out the entire documentation in one day, referring to the schematic shown in Figure 1. The garment length and sleeve length shown in the figure are symbolic and are not taken into account for the assignment of the fit.

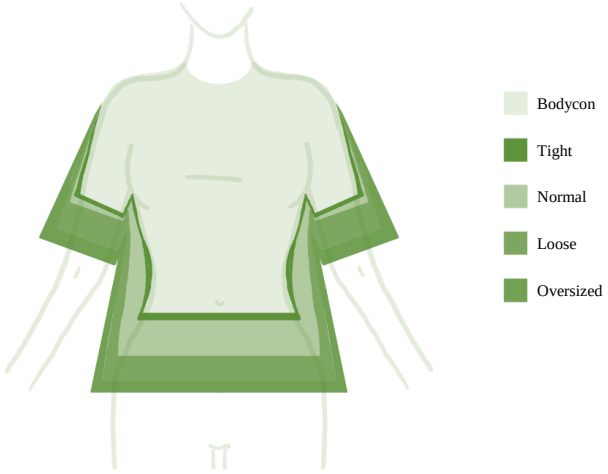


Figure 1. Schematic Overview for the Differentiation of Fit of the T-Shirts

The documentation of the fabric composition and fit of the garments allows us to gain an in-depth overview of the utilized materials, the typical content values of elastane in fiber blends and the fit of garments in this product group and thus will allow us to draw conclusions between the material compositions and the fit of the garments, enabling us to find the most utilized blends and providing a basis for future ecodesign recommendations for T-shirts.

As the information regarding the fiber composition of the garments cannot be tested for correctness in a lab during this research, we can only take the information provided by the brands into consideration.

4. RESULTS AND DISCUSSION

In this study, we analyzed a total of 519 garments, of which 56 were marked as sportswear. For both brands, the amount of sportswear items (H&M 30 of 285; Primark 26 of 236) is equivalent to 11 % of the total analyzed garments. Sportswear items will be looked at separately, as they usually have higher elastane content values due to the higher requirements regarding movability corresponding with active movements.

Of the remaining 463 T-shirts, as seen in Figure 2, a total of 219 (47 %) garments were made from mono materials, predominantly from cotton (H&M 125; Primark 89). Fourteen garments were made from fiber blends containing four different fiber types. With a total of 183 T-shirts the majority of fiber blends were a combination of two fibers, 75 % of those garments did contain elastane fibers in the blend. From the 47 garments made from three different fibers, only three garments did not contain any elastane. In the blends made from four fibers, elastane was always present, so were PET and Wool fibers. The fourth fiber was either PAN or CVI.

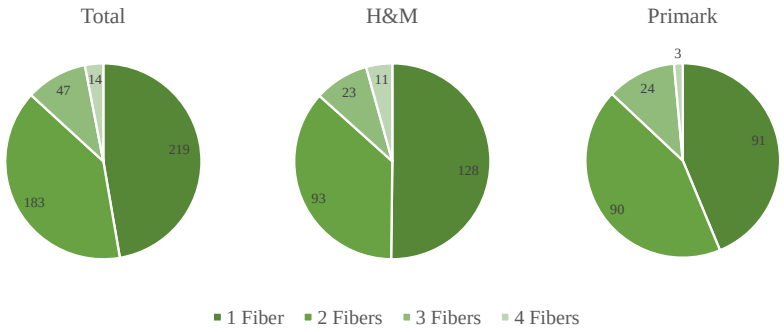
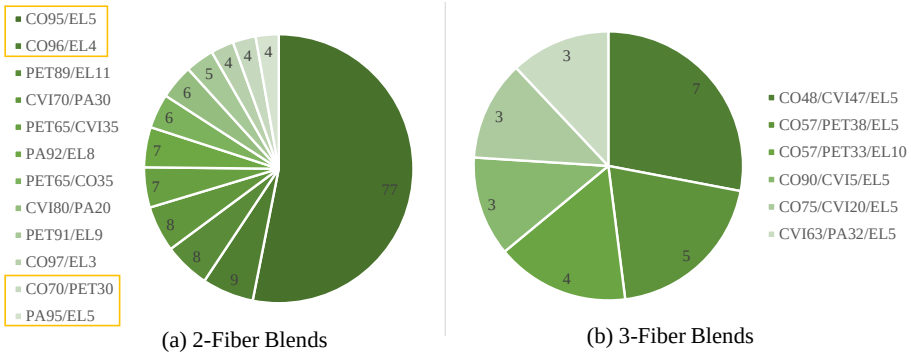


Figure 2. Distribution of number of used fibers utilized in T-shirts by H&M and Primark in no. of garments

A total of 58 different fiber blends have been used, of which only five blends were used by both brands (96 garments). We documented 35 2-fiber blends, 21 different 3-fiber blends and two 4-fiber blends. Figure 3 showcases the most common two- and three-fiber blends used. Only 2-fiber blends that have been

used for at least four times and 3-fiber blends that have been used at least three times have been considered in the figure. Four of the five fiber blends that have been used by both brands were 2-fiber blends. They have been marked in Figure 3 (a). The remaining blend is a 3-fiber blend that has only been utilized twice and hence did not make it into the diagram. Of all the 58 blends, 72 % (42) contained elastane fibers.



(a) 2-Fiber Blends (b) 3-Fiber Blends

Figure 3. Most utilized 2- and 3-fiber blends for T-shirts by both brands in no. of garments

To better understand the correlation between the fit of the T-shirts and the elastane content, we will first view both data separately before combining them into one diagram.

The distribution of the different fits of the T-shirts can be seen in Figure 4. Most of the T-shirts were Tight fitting (43 %), followed by what we classified as Normal (21 %) and Loose (21 %) styles (refer to Figure 1). Bodycon styles were not very common, being only used for six garments total.

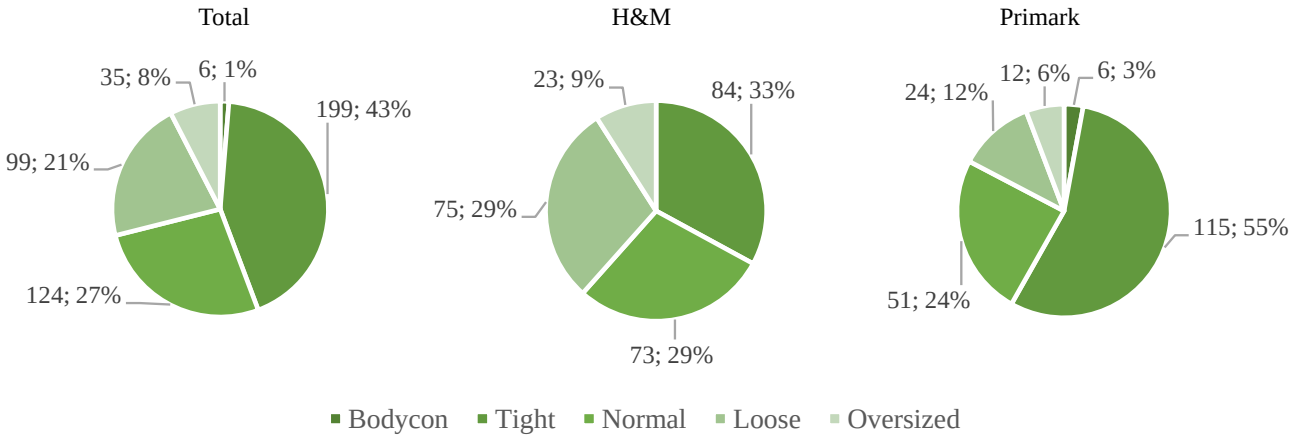
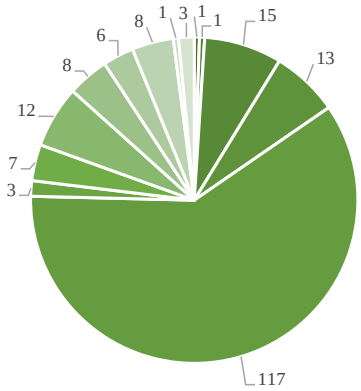


Figure 4. Distribution of different Fits of the T-Shirts from the brands H&M and Primark in pcs and %

The following Figure 5 shows the distribution of the documented elastane content values.

The most common elastane content value by far is 5 % with a total number of 117 T-shirts. Values of 3 %, 4 % and 8 % were each used more than ten times. The least utilized were values of 1 %, 2 % and 13 % with just one garment respectively. We documented 13 different elastane content values in this study, most of which differed by only one percentage point.



EL in %	Total
1%	1
2%	1
3%	15
4%	13
5%	117
6%	3
7%	7
8%	12
9%	8
10%	6
11%	8
13%	1
20%	3

Figure 5. Most used elastane content values in blends for T-shirts by the brands H&M and Primark in pcs

Figure 6 shows the elastane content values used for the different fits. As previously mentioned, 5 % is the most frequently used elastane content value. It is most often used for fits categorized as Tight with a total number of 90 garments. Other elastane values for that fit category are 4 %, 7-11 %, 13 % and 20 %. T-shirts classified as being Normal in fit most often had elastane content values of 3 % (15 pcs) and 5 % (17 pcs).

Oversized T-shirts most often did not have any elastane fibers in the fabrics used, only four T-shirts had elastane values of 2 %, 5 % and 6 %. The sample size of T-Shirts with a Bodycon fit was relatively small with only 6 documented garments, all of them did have elastane fibers in their blends with values reaching from 4 % to 8 %. Only seven T-Shirts with a Loose fit had elastane fibers present. The values reached from 3 % to 5 %.

The number of T-shirts without any elastane fibers present is relatively high with 219 documented mono material T-shirts and 16 blends without elastane fibers (49 T-shirts), resulting in a total of 268 garments or roughly 52 % without any elastane fibers. Except for T-shirts with a Bodycon fit, all other categories had garments without elastane fibers. 33 % of Tight T-shirts are made without any elastane fibers, and 45 % are made with a 5 % elastane content value.

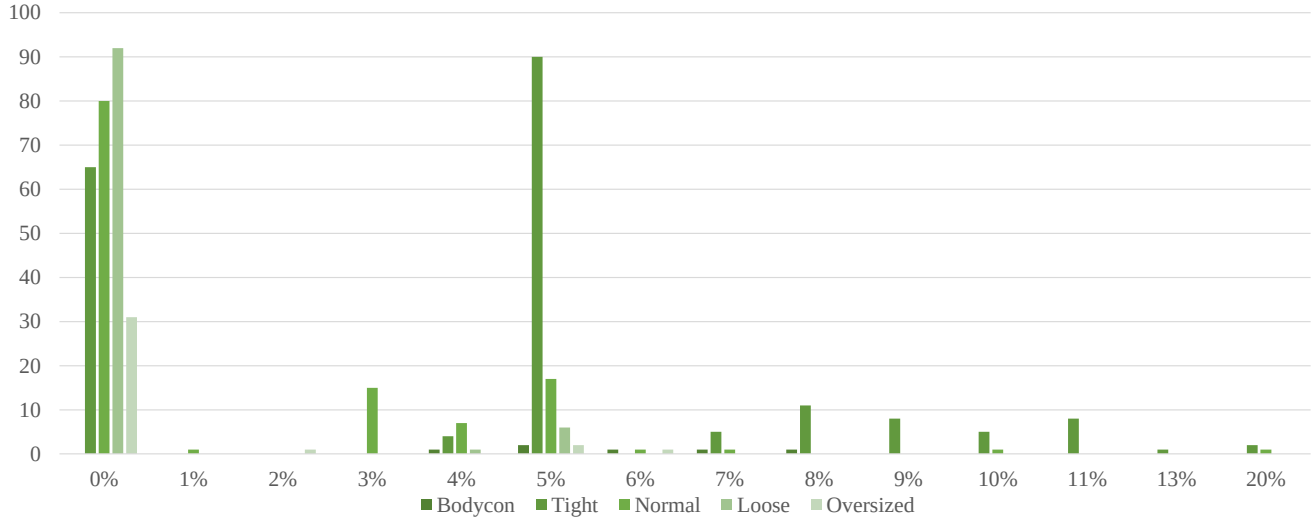


Figure 6. Elastane content values of T-shirts paired with the fit from the brands H&M and Primark in pcs

The previous results show a large number of different fiber blends utilized for T-shirts with up to four different fibers mixed together. While there were 58 blends documented, only five were used by both brands. This again showcases how unpredictable the material composition of collected old garments can be and underlines the necessity of ecodesign guidelines that restrict the unrestrained mixing of fibers. The blending of fibers can of course have economic or physiological reasons and should not be prohibited,

though the deviation of a few percentages does not seem to bring any recognizable advantages, only complicating the waste management process. Despite the large variety of blends, 47 % of all garments were made from mono materials, especially cotton fibers, making them very attractive for F2F recycling.

Elastane seems to not only to be used when necessary, but rather appears at random, depending on the availability of the fabrics or for reducing wrinkles of cotton knits. As mentioned before, knitted fabrics already have the ability to stretch without the needs of elastane fibers. Especially for Loose and Oversized fits, elastane fibers simply are not necessary. The number of garments from those fit categories was 134 in total, of which 11 did have elastane content values reaching from 2 % to 6 % nevertheless. This could definitely be prevented with more suitable material selection tailored to the actual garment that is to be produced from the purchased fabrics.

The correlation between high elastane content values and Tight fits is not as prominent as expected. Of all the 199 garments classified as Tight, around 33 % did not have any elastane content, 45 % did have an elastane content of 5 %. This again showcases that it is not necessary to add elastane fibers into knitted fabrics by default, though we do acknowledge the advantages that small quantities of elastane fibers bring especially for Tight fits, as they improve the comfort and can enhance the length of the lifecycle by preserving the dimensional stability for longer.

We documented a large variety of different elastane content values. Most of them did only differ by one percentage. This seems to be rather excessive and raises the question whether this has any real impact on the functionality and comfort of the garment or if the values could be condensed. We will look into this in more detail in the conclusion.

The following figures are the results from the sportswear T-shirts, which have been looked at separately. From the 519 analyzed garments, 56 were marketed as sportswear items by the brands. As mentioned before sportswear made up 11 % of the total T-shirts offered in the online shops by both brands.

The sample size for sportswear items in this study is relatively small. Nevertheless, those 56 garments were made from a total of 11 different 2-fiber blends of which only two have been used by both brands for a total of 24 garments (43 %). Figure 7 depicts the utilized blends. The two most popular blends both have high elastane content values of 13 % and 20 %, blended with a man-made synthetic fiber. Two of the blends which were used for a total of six T-shirts did not contain any elastane fibers but are polycotton blends with different content values.

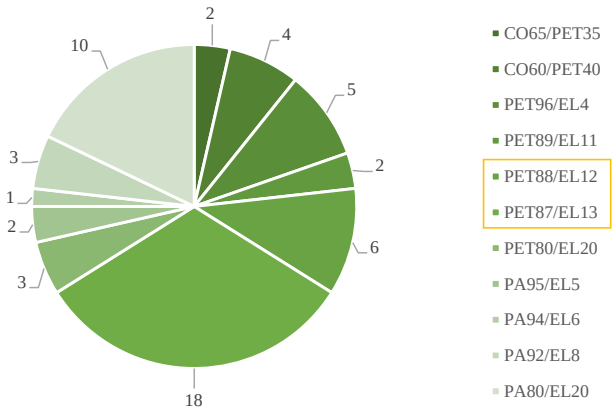


Figure 7. Most utilized blends for sportswear T-shirts by the brands H&M and Primark in pcs

For the fit of the sportswear garments, we did not document any of the category Oversized. Figure 8 shows the distribution of the other styles. The most used fit is Tight, followed by Normal. Loose styles have only been used three times. Primark offered a rather large number of Bodycon styles, this included several items more in the style of sports bras. The majority of fits used for sportswear T-shirts are from the categories Bodycon and Tight with 59 % total.

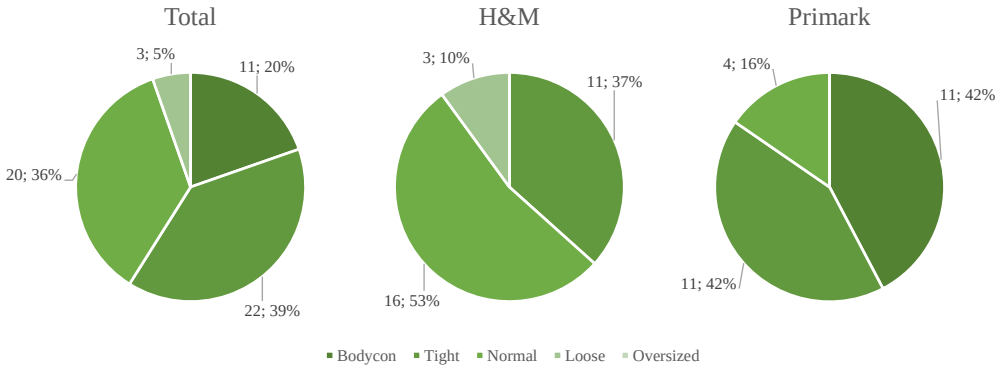


Figure 8. Distribution of different Fits of sportswear T-Shirts from the brands H&M and Primark in pcs and %

The elastane content values for sportswear T-shirts are shown in Figure 9. All of the documented garments had some elastane content in the 2-fiber blends used. The elastane content value was over 10 % for 39 of the garments or a total of 70 % of all documented sportswear T-shirts. The most popular content values are 13 % and 20 % with a total of 31 garments combined.

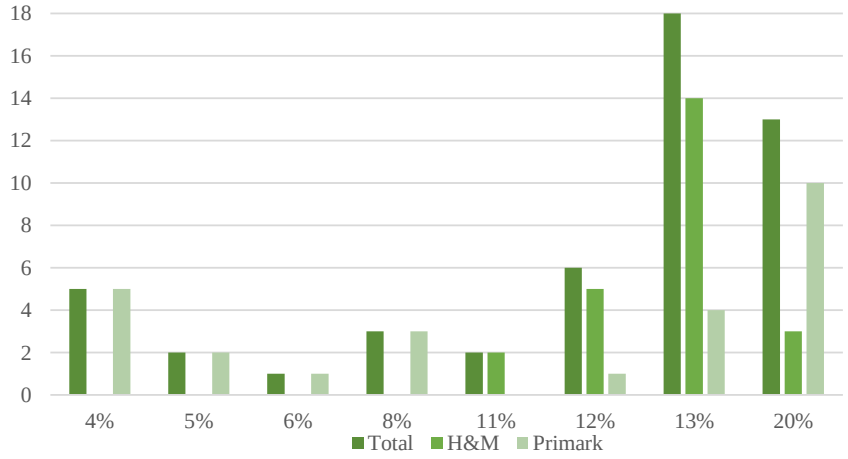


Figure 9. Most used elastane content in blends for sportswear T-shirts from the brands H&M and Primark in pcs

Figure 10 showcases the elastane content values used for the different fits of sportswear T-shirts. As mentioned before, the most popular elastane content values for sportswear T-shirts are 13 %, which is mostly used for Normal (12 pcs) and Tight (6 pcs) fits, and 20 % which is used for Tight (9 pcs) and Bodycon (4 pcs) styles. The six garments without elastane content are of either Loose or Normal fit.

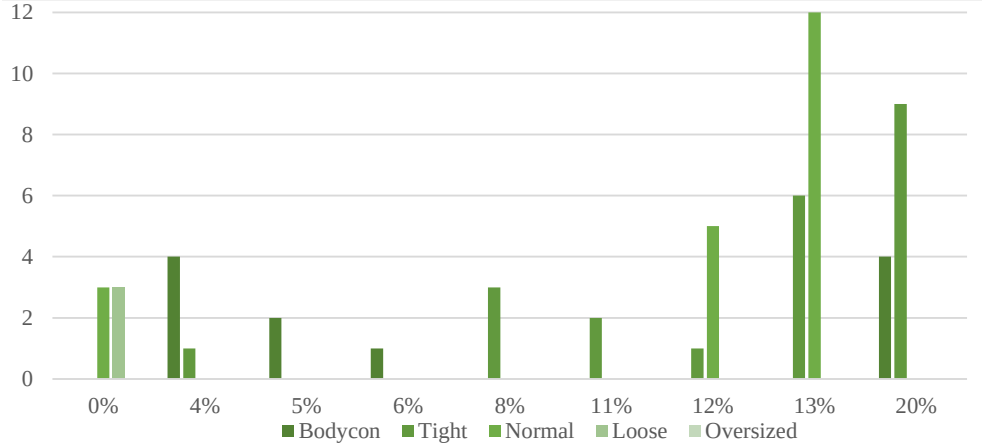


Figure 10. Elastane content values of sportswear T-shirts paired with the fit of the brands H&M and Primark in no. of garments

The results from the analyzation of sportswear T-shirts show that compared to the normal T-shirts looked at previously, sportswear usually has higher elastane content values present in the blends. Comfort and high degree of freedom of movement are key factors for the design of sportswear. Tighter fits prevent fabrics clinging randomly to the skin during sports but require higher elastane content as not to disturb or restrict the wearer during active movements. This results in the larger number of fits closer to the body, the utilization of 2-fiber blends containing elastane as well as the higher elastane content values.

There were no garments made from mono materials. Cotton fibers were always blended with PET, as cotton on its own will absorb a lot of moisture and cannot transport it away from the body to a degree that is necessary during active sports. Thus, they are blended with polyester fibers, which will improve the transportation of moisture (Uttam 2013). Moreover, cotton fibers can be reactive towards sweat, resulting in a weakened fabric structure or stains and discoloration, which is why synthetic fibers are favored over natural fibers for sportswear (Nasrin et al. 2023).

5. CONCLUSION

To improve F2F recycling, it is best to have as little contamination as possible in the materials and to know the composition of the material stream well. As shown previously, due to the large variety of fiber blends which currently are not restricted by any means, we can get garments with four different fiber types or even more blended together, making it nearly impossible to separate them in an ecological and economical matter. This also makes it very hard to predict the material composition of the old garments and introduce them to the best suited recycling technologies.

Elastane fibers are very hard to detect on top of it, as they are often deeply imbedded in the fabric structures and only present in rather limited amounts. As this study has shown, they are present in around 50 % of all T-shirts, making them a major obstacle for high quality F2F recycling. To improve F2F recycling and thus ultimately allowing the textile industry to close its loops, we are in need of specific ecodesign guidelines addressing fiber blends, content values of the fibers and contamination thresholds among many other things.

Thus, based on this study, we propose the following elastane content values for standard and sportswear T-shirts. The values depict in Table 2 could serve as a guideline, limiting the elastane content values based on the fit and the degree of performance (sportswear or not) that the garments will be exposed to. In the column “Previous Elastane Content Values” we show all the values we documented in this study, highlighting the most commonly used values in each category.

For our recommendation, we propose four different elastane content values which could be used. The values differ slightly within the fit categories, depending of the type of T-shirt that is to be produced. Generally speaking, the closer the garment is supposed to be worn to the body, the higher the elastane content value can be. The value reduces with every fit that is further from the body. The ultimate goal would of course be to use as little elastane content as possible as provided by the guideline.

Table 2. Proposed Elastane Content Values for different T-Shirt Fits and Applications

Fit of the Garment	Type of T-Shirt	Previous Elastane Content Values	Proposed Elastane Content Value
Bodycon	Standard	**4 %,** 5 %**, 6%, 7 %, 8 %**	**5 %, 10 %**
	Sportswear	4 %**, 5 %, 6 %,** 20 %	**5 %, 10 %, 20 %**
Tight	Standard	0 %**, 4 %,** 5 %**, 7 %,** 8 %**, 9 %, 10 %, 11 %, 13 %, 20 %**	**0 %, 5 %, 10 %**
	Sportswear	**4 %, 8 %, 11 %, 12 %,** 13 %**,** 20 %	**5%, 10 %, 20 %**
Normal	Standard	0 %**, 1 %,** 3 %**, 4 %,** 5 %**, 6 %, 7 %, 10 %, 20 %**	**0 %, 5 %**

	Sportswear	**0 %,** 12 %**,** 13 %	**0 %, 5 %, 10 %**
Loose	Standard	0 %**, 4 %, 5 %**	**0 %**
	Sportswear	0 %	**0 %, 5 %**
Oversized	Standard	0 %**, 2 %, 5 %, 6 %**	**0 %**
	Sportswear	**-**	**0%**

This categorization can be a guideline for the designers, technical product development and material acquisition teams and plays a part in the prevention of unnecessary elastane content in garments. Moreover, it will allow predictions regarding the elastane content values in used garment material streams, making it easier for F2F recycling companies to adjust their processes to the actual material input and thus enhancing the economic and ecological viability of those technologies. This can help promote F2F recycling and help the industry to become more sustainable, as we will need fewer virgin resources to satisfy the demand for new garments.

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