Glaukos

Circular solution for the textile industry

Market Study on Materials Used in the Textile and Sport Industry

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1. INTRODUCTION

BSI (the Association of the German Sporting Goods Industry) represents the interest of the German sport articles manufacturers at the national, European and international level. BSI members are some of the leading brands and producers of sporting goods in the segments clothing, shoes, and hardware – this market study is however focused exclusively on the textile sector and sports and outdoor clothing. In order to gain some insight into the utilisation of conventional and alternative materials in the textile industry, a literature review of the worldwide fiber production of all materials was carried out, followed by a questionnaire survey on the types of materials used in this industry that was conducted in cooperation with the association's members.

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2. OVERALL FIBER PRODUCTION

The production of textile fibers for different uses has been constantly increasing over decades. In 1975, around 10 million tons of man-made fibers were produced of which around three quarters (7.4 million tons) were synthetic, and one quarter (2.6 million tons) being cellulosic fibers[1]. This production was triplicated in 2000 to reach around 31 million tons of which around 28.4 million tons were synthetic. The production was again more than doubled in 2019 to reach 80.5 million tons of overall man made fibers of which 73.5 million tons were synthetic. The production development over time of the main components of the synthetic man-made fibers (as a breakdown) is listed in the table below[2].

Cotton production –a natural fiber – was also increased over the past decades. The production was 11.72 million tons in 1975 reaching about 26 million tons in 2018. Wool fiber production on the other hand slightly grew (from 1.58 million tons in 1975 to 1.93 million tons in 1990), but then began to decline to reach 1.08 million tons in 2018. The development of natural fiber production over time is listed in the following table as well.

Important to mention is the fact that these figures include the fiber production for all uses. However, taking into consideration the figures presented by FAO[3] about the world apparel fiber consumption in the period from 2000 - 2010, it can be concluded that over 90% of the total fiber production is employed in fabricating clothing. Thus studying the production development of the different types of fibers is directly connected to its main use, clothing.

[1] In this context the term „synthetic" refers to polyester, polyamide and other man-made fibers completely originating from non-natural resources (fossil fuels) contrary to those deriving from natural resources (like cellulosic fibers).

[2] Resources:
- Statistisches Bundesamt (Destatis) (German statistics portal for market data)
- IVC (Industrievereinigung Chemiefaser - the association of the German, Austrian and Swiss man-made fibres industries)

[3] FAO (Food and Agriculture Organization): World Apparel Fiber Consumption Survey - 2013

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Table 1: Global production development of the different types of fiber over time.

Type of fiber	Year									
	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
Polyester	3370	5130	6500	8670	11950	18900	24700	36210	52000	55100
Polyamide	2490	3150	3450	3740	3740	4120	3800	3970	4500	5400
Acrylic polypropylene	1390	2060	2380	2320	2440	2530	2500	2480	2400	-
Other synthetic man-made fibers	190	290	790	640	1060	2850	3800	2970	1800	6100
Overall synthetic man-made fibers	7440	10630	13120	15370	19190	28400	34800	45630	60700	66600
Cellulosic man-made fibers	3200	3560	3220	3150	3010	2640	3300	4400	6100	6800
Total man-made fibers	**10640**	**14190**	**16340**	**18520**	**22200**	**31040**	**38100**	**50030**	**66800**	**73400**
Wool	1580	1600	1740	1930	1490	1400	1100	1300	1100	1080
Cotton	11720	13840	17380	19000	19960	19000	24440	25100	22000	26050
Total of all fibers	**23940**	**29630**	**35460**	**39450**	**43650**	**51440**	**63640**	**76430**	**89900**	**100530**

In order to summarize the development of fiber production over time, all types of fibers are demonstrated in the figure below. Polyester is by far the most requested and manufactured type of fiber, which explains the rise of the production of synthetic fibers in total as polyester represents the main component. Worth mentioning as well is the promising development and increase of the production of cellulosic man-made fibers since the past 20 years. A further break down of the individual types of fibers is found below.

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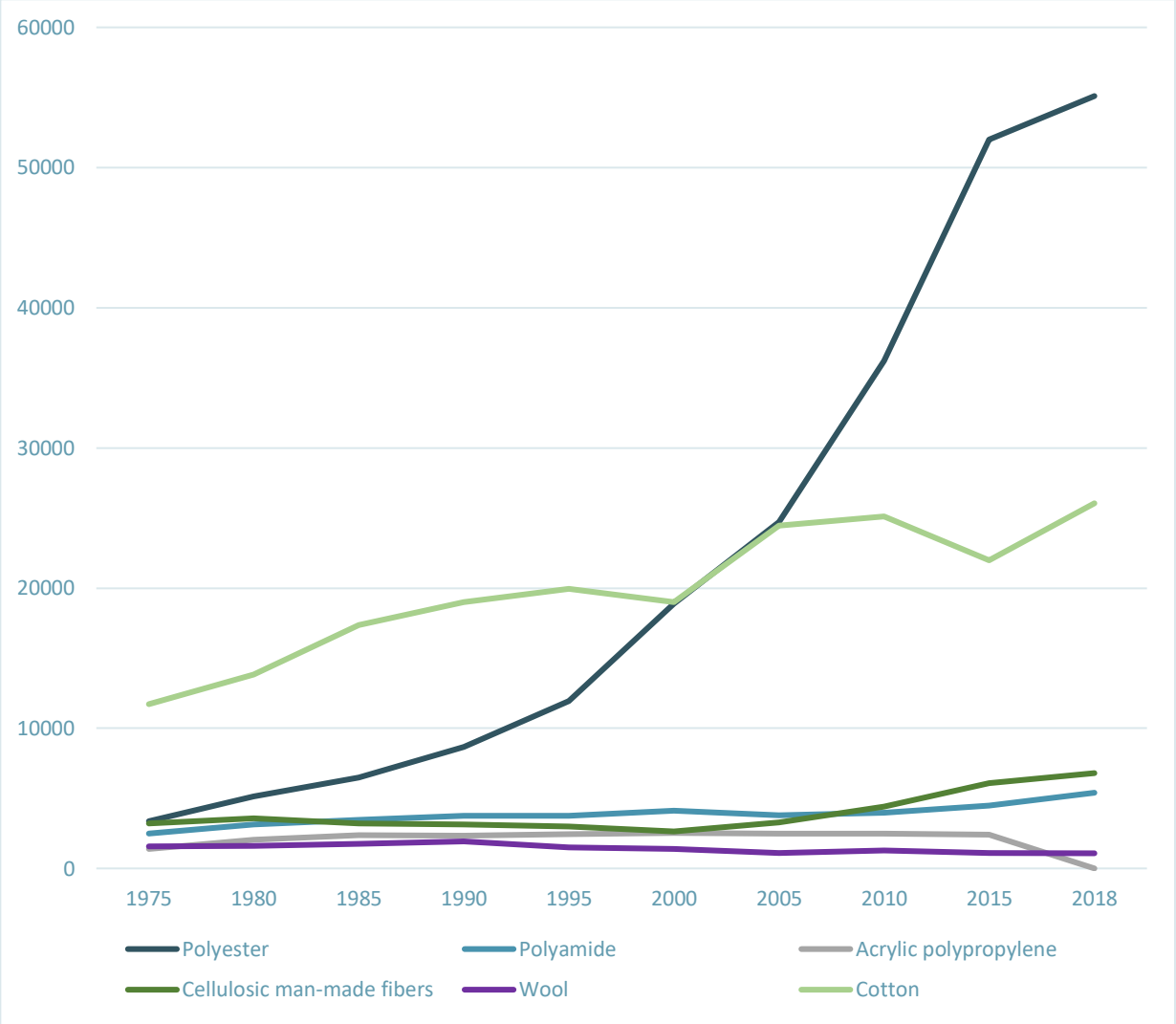

Figure 1: The development of different types of fiber production over time.

2.1. Polyester

Polyester is the most commonly used synthetic fiber with the highest increase of production volume from about 3.4 million tons in 1975 to 55 million tons in 2018 worldwide. It encompasses around 52% of the total global fiber production. The market share of biobased polyester including PTT (polytrimethylene terephthalate), PLA (polylactic acid), and PET (Polyethylene terephthalate is approximately less than one percent of the overall polyester

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fibers' production[4]. Since polyester is the main implemented polymer in the industry, optimizing this type of biobased form is recommended in terms of quality and quantity.

2.2. Polyamide

Polyamide is the second most frequent synthetic fiber in terms of production. It holds about 5% of the market share of the global fiber production (around 5.4 million tons in 2018). The global market share of biobased polyamide fibers represents less than 1% of the overall polyamide fiber production.

2.3. Cellulose man-made fiber

The global cellulose man-made fiber production volume has been considerably increasing over the past years. It has more than doubled from around three million tons in 1990 to around 6.8 million tons in 2018 and is expected to grow further in the coming years. Cellulose man-made fibers are currently primarily produced from wood and include: viscose (79% of the market share; 5.3 million tons in 2018), acetate (14%; 0.95 million tons – mainly used for non-textile application), lyocell (4%; 0.26 million tons), modal (2.7%), and Cupro (< 1%)[5].

2.4. Recycling textiles and recycled fibers

According to Ellen MacArthur Foundation (2015)[6], that less than 1 percent of all clothing is recycled back into clothing. The main part of used clothing (73%) ends up in landfills or is incinerated, about 12% are downcycled to lower-quality products and the rest gets lost during manufacture process.

Recycled polyester is mainly made from PET plastic bottles. The market share of recycled polyester increased from around 8 percent of the world PET fibers' production in 2008 to around 13 percent in 2018. Polyamide is more difficult to recycle than polyester and there is no reliable number on the global recycled polyamide production. Recycling of fiber blend textiles is considered a challenge due to the materials mixture (e.g. cotton/polyester)[7]. This represents another field of research to focus on.

[4] European Bioplastics: Bioplastics Market Data 2018
[5] TextileExchange: Preferred Fiber & Materials – Market Report 2019
[6] Ellen MacArthur Foundation: A New Textiles Economy - Redesigning Fashion's Future 2015
[7] TextileExchange: Preferred Fiber & Materials – Market Report 2019

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In order to summarize the information mentioned above, the two figures below indicate the current percentages regarding the distribution of the different types of fibers.

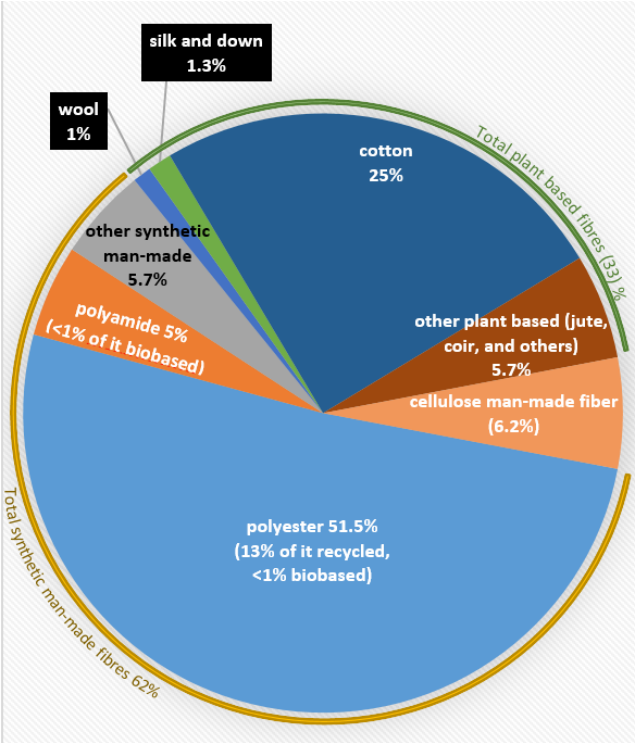

Figure 2: The distribution of percentages of types of fibers

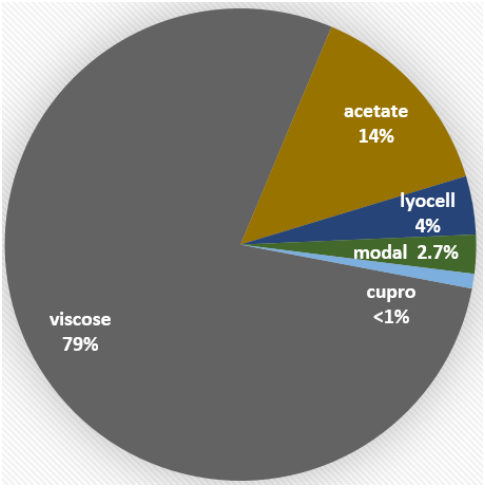

Figure 3: The distribution of cellulose man-made fibers

3. FIBER MATERIAL SURVEY

As mentioned in the introduction, BSI has conducted a qualitative questionnaire asking its members about the status quo as well as their plans of implementing sustainable (biobased and recyclable) materials in this sector, their performance, challenges they face, and the related added materials. The questionnaire has been directed to the CSR (Corporate Social Responsibility) departments in the members' companies concerned.

This survey rather being a qualitative research than a pure quantitative analysis focuses on gaining detailed and comprehensive information. It bases on the data and insights as well as experiences provided by eight member companies that play a considerable role in the sports and outdoor clothing market. The market shares of the participating companies as well as their status as international market leaders with high quality products allows inferences to be drawn about the extend the materials mentioned above are implemented in this area. We believe that the data provided can be a basic measure of the use of sustainable materials in the sports textile industry.

The questions asked included the following aspects:

- Most commonly used materials
- Use of alternative fiber materials

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- Desired performance properties
- Most used additives in the finishing process
- Look into the future / challenges
- Sustainability in textiles

3.1. Most commonly used materials

The participating companies were asked to identify the top first 5 types of fibers used in their manufacturing process. Similarly to what found above in the review of the global fiber production, polyester and polyamide are the most used fiber materials in the textile sector. In fact, the most common use of polyester in textile industry in general and particularly in sports clothing has been the driving factor for this market study. It is necessary to gain more information about the application of polyester in the industry, the specifications needed, as well as further important characteristics in order to develop a sustainable alternative. Elastane is the third most used fiber. This is due to the considerable usage of elastane in sportswear. Other fiber materials mentioned are wool, cotton and polypropylene.

3.2. Alternative materials

We have asked our members about the conversion into the use of biodegradable synthetic fiber materials as an alternative to conventional synthetic fibers. Only a few participants revealed that they have converted some products to such alternative materials. On the other hand, almost all participants plan to implement such materials in the future. In the light of the limited applicability of these kind of materials, it can be concluded that the industry still sees this application sceptically, and the topic of biodegradable materials needs to be surveyed further.

Regarding the recycled fiber materials, almost all participating companies have indeed implemented such materials and converted some of their products to this alternative. rPET is mainly used in this area for a set of textile products, such as midlayers, shirts, pants, hardshell fabrics, down proof insulation fabrics, and various fleece products.

Some aspects hindering the implementation of alternative fiber materials have been referred to, and are summarized and listed as follows:

- Lack of or insufficient performance or quality properties (Life span/ durability, water repellency, wind resistance, tear resistance, breathability, haptic)
- Processability of the fiber material
- Additives cannot be applied (coating, dye, ...)
- Availability / quantity of raw material on the market
- Price / performance ratio

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However, some more details and discussion about future applications of the alternative materials and their challenges will be referred to in a later section.

3.3. Desired performance properties

In order to discover the most important performance qualities fiber materials should have to fulfil the requirements for sports and outdoor clothing, the companies were asked to evaluate - on a scale from 1 to 5 (least to extremely important) - the importance of some selected features. The figure below demonstrates the outcome.

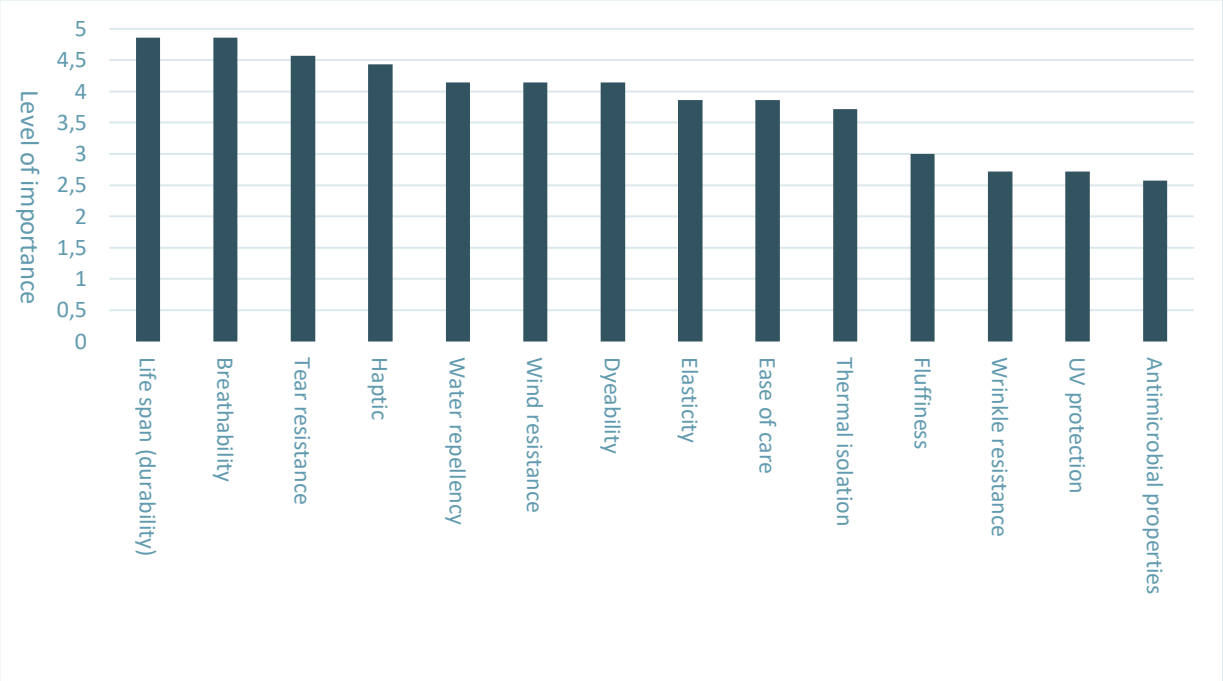

Figure 4: Level of importance of fiber performance qualities

Both durability and breathability are the most important qualities a fiber material should have in order to be processed in the textile industry. The high importance of breathability is due to this feature's necessity in sportswear. Tear resistance and haptic characteristics follow the qualities mentioned above. Including the wind resistance as the fifth important quality, it can be concluded that the structural features of a fabric in general are the most important qualities that should be well-considered and investigated in the textile industry sector. These are followed by functional characteristics that can be applied by modifying a fabric or processing some external applications such as water repellents, plasticizers, and isolators or other protectors.

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3.4. Most used additives

There are some additives that were mentioned by the participating manufacturers, which are used in some top sellers' products. The respondents mainly referred to DWR coatings (free of PFCs) as well as plasticizers. Other additives included antimicrobials, UV treatment and wicking finish.

3.5. Look into the future / challenges

The participants were asked – taking into account the future plan of the coming 5-10 years – to assess the most important performance characteristics needed for fibers.

Durability is still the most desired performance quality (as found in section 3) that needs to be maintained. Worth mentioning is that recyclability is the second important required feature for future fibers. The participants also referred to the desired ability of conducting an effective und pure sorting of the used fibers as a prior step to an efficient recycling process. All other characteristics mentioned are also mainly environmental-friendly ones (listed below) which reflects the grown awareness of essential eco-friendly alternatives. Other required characteristics are:

- Biodegradability
- Improved natural fibers performance that equals the functions of synthetic man-made fibers
- Easy care
- PFC-free with improved DWR performance
- Protective function - Protection against allergies, diseases, injuries etc.
- Ability to measure the materials footprint – finding a criteria/procedure
- Reduction of microplastics

On the other hand, the manufacturing companies named the obstacles or barriers hindering them to implement the alternative fibers (biobased, recyclable).

The costs of such materials in regard to the desired qualities is an important point that was considerably referred to. This is certainly interrelated with the materials' performance which still lacks the required qualities mentioned above (durability, resistance, water repellency, etc.). The missing availability on the market was also mentioned as one of the main obstacles to use these alternative materials.

One respondent referred to another aspect that is related to the lack of consistent standards for bio-based materials. Developing such a standard would avoid confusion between bio-based materials with indeed biodegradable ones, and could determine the conditions of biodegradability / composting. In case of implementing these materials in textiles, other related additives such as dyes need to be degradable as well.

Some other obstacles mentioned could be related to missing knowledge. Companies may need to be informed about a classification for alternative fiber materials that actually have a positive impact on the climate footprint. There is also a need for a better consumer education regarding the recovered substance cycle, the materials used as well as the recycling concept itself.

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3.6. Sustainability in textiles

In this section, the participating companies were asked to provide some details connected directly to the end products. What do the consumers expect concerning a “sustainable product”? In order to shed more light on the required durability of sustainable products, it is necessary to know the expected lifespan when designing a product. To what extent does conducting an LCA (life cycle assessment) play a role?

The sustainability aspects of textiles that are most frequently requested by the customers were about the recycled materials and the ecological composition of the products (vegan, bio-based, etc.). These aspects were put first, followed by the concern about a possible harmful content of a product (such as PFCs).

Other ecological aspects were:

- Traceable production
- Durability
- Repairability
- Sustainable processing / sustainable commitment of the brand
- Environmentally friendly disposal
- Environmental labels / certification such as "Fair Wear Foundation"

For the top sellers in the apparel segment, the average lifespan ranged from 5 to >12 years depending on the product: jackets 10 to 15 years, trousers 5 to 10 years, T-shirts 2 to 5 years.

According to the answers received, LCA studies are still very limited. A few companies plan to expand such studies in the future in order to improve the sustainability of products.

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4. SUMMARY AND CONCLUSION

Textiles and clothing is a highly growing industrial sector that has duplicated in terms of production volume over the past decades and is expected to grow even further in the coming years. The increased production and usage of synthetic fibers, specifically polyester, is certainly the main factor affecting this trend. Thus centering on the efforts of finding alternative and sustainable solutions in that area is highly needed. The market share percentage of manufacturing products from recycled polyester – currently mainly from plastic bottles - seems to be promising, but the very low percentage of biobased polyester being less than 1% of the overall polyester production reveals that it is still in its infancy.

The results of the survey confirm that the use of conventional / fossil-fuel based fiber materials still dominates in the textile market. The conversion to alternative materials has not moved beyond the initial phase yet, especially in case of biobased/biodegradable ones. Reasons mentioned include the higher cost / lower performance ratio compared to conventional materials. The process of using recycled polyester however has already found its way - some clothing articles are already manufactured using recycled polyester, and the future intentions of the companies seems to be encouraging as well as the growing demand of the consumers.

In order to facilitate the inclusion of alternative materials in textile as well as sports clothing sector, some performance qualities need to be focused on. The survey has shown that the structural features of a fabric are of great relevance followed by the functional characteristics that can be applied to the texture at a later stage. Such functional features include mainly DWR coatings and plasticizers which should be carefully examined for a safe and ecological use in this industry.

Ecological and environmental aspects are of great importance and, to an increasing degree, play a major role for companies just as much as developing premium class products with well-designed performance qualities.

Some further operational and educational background is also required to facilitate the conversion into circularity. Conducting LCA studies for specific conventional and “future” sustainable textile products will certainly support the ecological conversion process.

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