

Global Trends for Fibre Production and Marketing

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Abstract – Textile consumers’ fiber preference varies owing to environmental, social, and economic impacts every year. The world population has increased and because of this, new ways for a sustainable textile production have been more focused. The requirement of more responsible utilization of world resources has become more aware in recent years. Due to the restriction of energy sources among the world; There should be a transition from fossil-based fibers to preferred sources. Hence new variations such as recycled, biobased fibers are more considered with a sustainable manner. This study generally gives a general information about the latest preferred fibre types and the main fibre production strategies considering the low consumption of natural sources.

Keywords – Natural Fiber, Synthetic Fiber, Recycled Fiber

I. INTRODUCTION

The reduction on the emissions has vital importance for the sustainable global fiber and material production. Fibre production among the world in 2021 increased to 113 million tonnes. There was a slight decrement in 2020 due to COVID-19. The fibre production has been twiced from 58 million tonnes to 113 million tonnes between the years 2000 and 2021. It is thought that it will reach to 149 million tonnes in 2030. It is also observed that the amount of recycled fibers slightly reached from 8.4% in 2020 to 8.9% in 2021 because of the increment in the bottle based polyester fiber. Less than 1% of the global fiber market was from recycled textiles in 2021. The production of fossil based synthetics rose from 60 million tonnes to 63 million tonnes between the years of 2020 and 2021 [1]. The general information about the main fibres utilized in textile products will be given as below.

Some of the recognized programs defined the market share of “preferred cotton”. It is declared that the market share of “preferred cotton”

decreased from 27% of the total cotton production in 2019/20 to 24% in 2020/21. Some reasons may be sorted for this such as weather variations, changes in the Better Cotton program, market conditions and socio-political challenges. With a market share of 54%, polyester is the most widely produced fibre among the world. Low prices of fossil-based polyester led to recycled polyester market growing slowly. There are some encouraging programs for increasing the polyester market.

More than 132 brands and suppliers have signed on the agreement for increasing the share of recycled polyester to 45% by 2025. It is observed that most recycled polyester is still provided from plastic bottles. Ocean-bond plastic is another prominent raw material for the recycled polyester. Due to high prices, availability, the market share of biobased polyester fibre remained low [1]

Polyamide accounts the market share of 5% among the global fiber market in 2021. Due to low prices for fossil based polyamide and technical innovations, the market share of recycled polyamide did not exceed 2% of all polyamide fiber. Polyamide draws attention with its transition to

recycled and biobased polyamide. Most recycled polyamide is obtained from discarded fishing nets and carpets. Low uptake of biobased polyamide was attributed to price, availability and the hesitates around the sustainability of biobased polyamide which suppressed the increase of the market. Production of manmade cellulosic fibres (MMCFs) including viscose, lyocell, modal, acetate, and cupro rose from 6.5 million tonnes in 2020 to 7.2 million tonnes in 2021. So many research and development attempts continue for the increment of MMCFs volumes within the following years.

Wool production was at around 1 million tonnes in 2021. Although conventional wool constitutes most of the wool market, the RWS (Responsible wool standard) market share alone increased from 1.23% in 2020 to 2.62% in 2021 on a global average. In the main wool producing countries, the market shares were as high as 30% in South Africa, 17% in Uruguay, and 15% in Argentina. Responsible land use and biodiversity, positive impacts on animal welfare were created with the entrance to new wool programs related to responsible land use and animal welfare. Recycled wool had a market share of around 6% of the global total wool market.

Global mohair fiber production in 2021 was around 4,320 tons of greasy fiber. A new Responsible Mohair standard (RMS) covering both animal welfare and responsible land use criteria was presented in March 2020. The production of RMS rose from 20% to 35% of all mohair produced worldwide in 2021. The RMS market share raised to 67% of the total mohair production in South Africa and 42% of the total mohair production in Australia in 2021. Global alpaca fiber production was around 6,000 tonnes in 2021. In April 2021, Textile Exchange announced its Responsible Alpaca Standard (RAS) with animal welfare and responsible land use criteria.

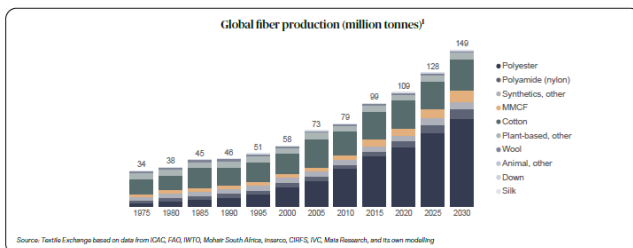


Fig. 1 Global fibre production (million tonnes) [1]

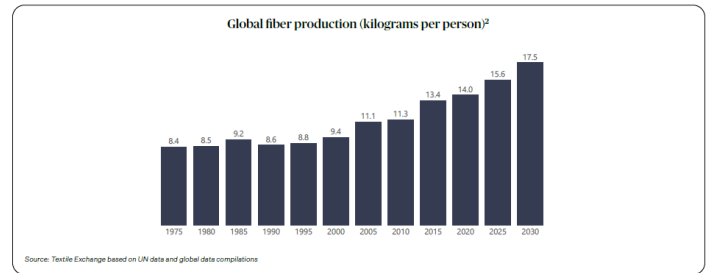


Fig. 2 Global fibre production (kilograms per person) [1]

II. GLOBAL FIBRE MARKETS AND THE LATEST STRATEGIES

A Closer Look at the Virgin Cotton Programs

The BASF e3 is one of the best known cotton cultivation programs. The BASF e3 cotton production increased from 160,754 tons in 2019/20 to 214,861 tons in 2020/21, equaling 6.75% of all US and 0.88% of all cotton produced worldwide in 2020/21. **Better Cotton production**, including equivalents, decreased from around 6.2 million tons in 2019/20 to 4.7 million tons in 2020/21. Better Cotton, represented around 19% of all cotton production in 2020/21. In 2022, Better Cotton production in Pakistan was severely undermined by the flood. **Cotton made in Africa (CmiA)** production rose from 629,789 tons in 2019/2020 to 677,479 tons in 2020/21. This equaled 2.8 % of all cotton produced in 2020/2021 and around 38% of all cotton production in Africa in 2020/21. Almost all (91%) of the CmiA produced in 2020/21 was also accounted for as better cotton equivalent.

Fairtrade cotton production increased from 16,150 tons in 2019/20 to 18,097 tons in 2020/21, equaling 0.07 % of all cotton produced in 2020/2021. Approximately 65% of all Fairtrade cotton in 2020/2021 was also certified to an organic standard [2]. **International sustainability and Carbon Certification (ISCC)** cotton production increased from 132,626 tons in 2019/2020 to 148,158 tons in 2020/2021. This amount equaled 0.61% of the global cotton production and 46% of the cotton production in Greece in 2020/2021. All ISCC certified cotton in 2020/2021 was produced in Greece [3]. **myBMP cotton** production increased from 31,411 tons in 2019/20 to 144,528 tons in 2020/21. myBMP is also accepted as Better Cotton equivalent [4]. **Organic cotton production** rose

from 249,153 tons in 2019/20 to 342,265 tons in 2020/21. Organic cotton accounts the market share of 1.4% of all cotton produced in 2020/21. The organic cotton production volume contains all IFOAM Family of Standards recognized organic cotton which also contains CmiA organic, Fairtrade organic, ROC, and supplier specific programs such as bioRe®.

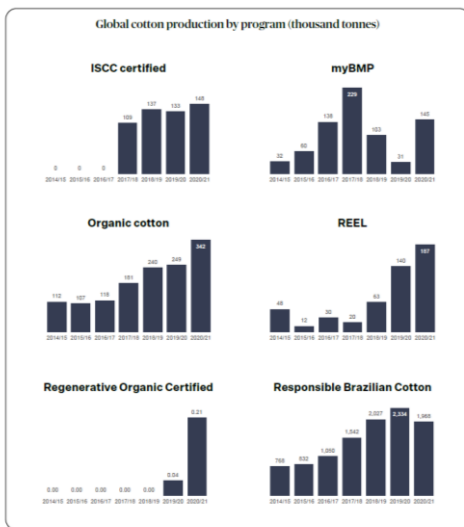


Fig. 3 Global cotton production by program (thousand tonnes)

Recycled Cotton

The market share for recycled cotton was 1% of total amount in 2021. However, it is thought that there will be a significant grow in the following years. Nearly 25 million tons of virgin cotton were produced in 2021, the production volume of recycled cotton is roughly predicted at around 272 thousand tonnes [5]. Circular Fashion partnership revealed that textile waste is utilized from efficiently focusing on Bangladesh. The research has revealed that Bangladesh alone produced 250 thousand tonnes of 100% pre-consumer cotton waste in Ready-Made garments [6].

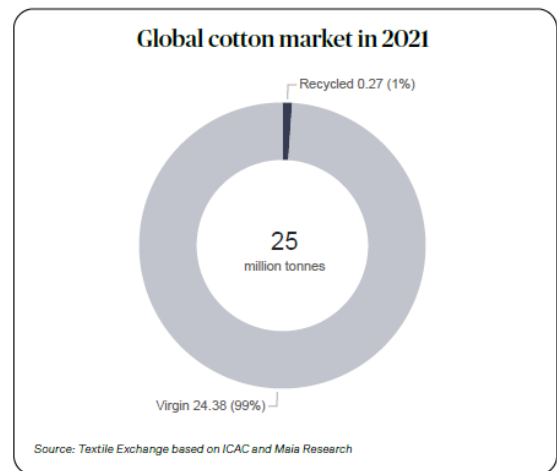


Fig. 4 Global cotton market in 2021

Other plant-based fibers

Other plant-based fibres contain different fibres such as jute, coir, flax, hemp, sisal, abaca, kapok, ramie, agave fibres, and henequen. It is known that more than 8 million households are included in the production of these natural plant-based fibres. With a global production volume of around 6.7 million tonnes, the market share of these other plant-based fibres was nearly 6% of the total global fibre production volume in 2021.

Jute constitutes the largest market share of all other plant-based fibres with around 50%. Jute is a bast fibre. This durable fibre may be utilized for making twine, ropes, matting, and packaging materials, as well as home textiles such as curtains and carpets.

Coir is the second plant-based fibres sharing the second largest market. It is extracted from husks of coconuts for producing home textiles such as floor mats, doormats, brushes. Global flax fibre and tow production in 2021 is predicted at around 1 million tonnes. Processed flax, also called linen, is utilized for a variety of products such as home textiles and apparel. **Hemp** fibre and tow had an estimated global production rate of around 0.25 million tonnes in 2021. The bast fibre hemp is used in various industries including home textiles and apparel. Further plant-based fibres include sisal, abaca, kapok, ramie, agave, and henequen [7]

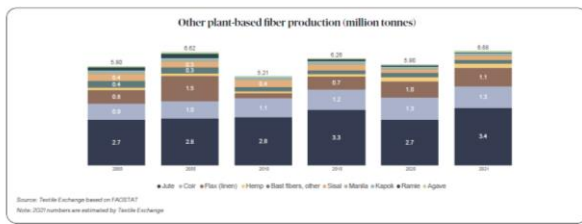


Fig. 5 Other plant-based fiber production (million tonnes)

Additional plant-based fibres used in the textile industry include nettle, kapok, lotus, and others. The use of crop residues, such as rice straw, pineapple leaves, banana tree trunks, and sugar cane bark, is another new existing field. Alternative Materials Science company (AltMat) is improving fibres made from medicinal crops and residues of food.

The technology is appropriate for various kinds of biomass including stalks and leaves of fruit crops. A combination of mechanical, chemical, and microbial sciences is benefited from to transform the low-value materials into soft and strong fibres [8]. Himalayan Wild farmers extracts textile fibre from a nettle plant that grows wild in the mountain forests of the Himalayas. Wild-growing, giant Himalayan stinging nettle is a perfectly sustainable rhizome, with shoots annually reaching over three meters in height [9].



Fig. 6 Nettle Plant in Himayala

Spinnova is a Finnish company which uses a proprietary, innovative mechanical way to produce textile fiber from micro-fibrillated cellulose (MFC). Spinnova and the world's largest wood pulp producer Suzano presented the construction of their first commercial-scale SPINNOVA® fiber production facility, called Woodspin, in Finland (2020). The facility, producing SPINNOVA® fiber, is the first step towards the ambition of scaling

production volume to 1 million tons of annual capacity by 2031.

Wool, Recycled wool and Other Animal Fibers

Sheep wool is the most utilized animal-based fibers with the annual production volume of nearly one million tons of wool fiber. The market share of wool programs has increased although the global wool production has been decreasing [11]. Mohair is the hair of the angora goat. In 2021, around 4,590 tonnes of raw mohair fibre were produced globally. Nearly half of the global mohair (2,330 tonnes) was produced in South Africa. The remaining mohair was produced in Lesotho (750 tons), Turkey (470 tons), Argentina (360 tons), United States (250 tons), New Zealand (20 tons), Australia (80 tons), and other countries (330 tons). Since 2009, The South African mohair industry has been checked by its own Sustainable Mohair Production Guidelines. These industry guidelines have been improved and regularly modified by the South African Mohair Growers Association.

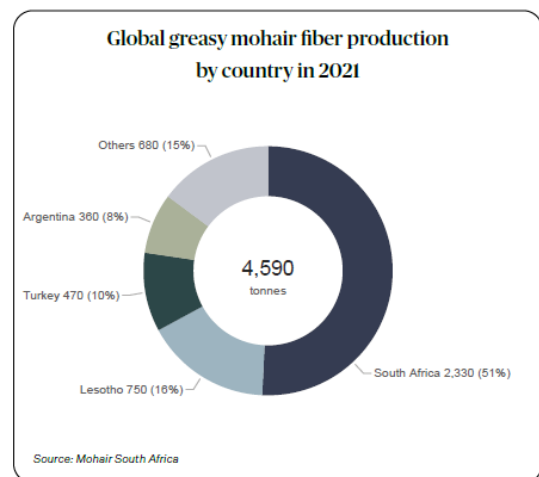


Fig. 7 Global greasy mohair fiber production by country in 2021.

Cashmere which is the hair of cashmere goat is mainly produced in Mongolia, China. Around 26,121 tonnes of greasy cashmere fibre were produced among the world in 2021 [12]. Alpaca fibre is the hair that is provided from Alpaca. Due to its fine micron range, alpaca fibre was reserved for royalty historically. Today, most of the alpaca still live in the highlands or Peru at an average of 11,000 to 16,000 feet (3,500 to 5,000 meters). About 4 million alpacas live in Peru. They also appear in the other countries such as Bolivia, Australia, UK with the small percentage. Huacayo fleece is the main

variation used in textile and knitwear production. More than 90% of all fibre produced in Peru comes from smallholder farmers. These farmers have on average 45 animals. This fiber is currently collected and sold by middlemen and then processed by the two large processors [13]. Additional animal fibers—apart from sheep, cashmere, mohair and alpaca—may be followed as angora rabbit, camel, guanaco, llama, vicuna, and yak hair. Angora wool is the hair of angora rabbits. 90% of Angora is produced in China. Europe, Chile and the US also produce smaller quantities. Several major brands and retailers have prohibited Angora due to animal welfare concerns. Camel hair comes from camels. Major suppliers of camel hair are Mongolia, Tibet, Afghanistan, Iran, Russia, China, New Zealand and Australia. Yak fibre is the hair of yaks which are mainly found in the Himalayas and some areas of Mongolia and Central Asia. Yak hair has been used in the Himalayan region for over a thousand years and more recently has been presented as premium fiber in the international fashion industry.

Recycled wool has a long tradition. With an estimated production volume of around 70 thousand tonnes, the market share of recycled wool is predicted at around 6% of the total wool market. The Italian district of Prato is a major producer of recycled wool, where approximately 22,000 tonnes of wool are recycled every year. Other major production centres for wool recycling are Panipat, India and China.

Silk

Silk is produced by the silkworm, *Bombyx mori*. Fed on mulberry leaves, it produces liquid Silk that hardens into filaments to form its cocoon. The larva is then killed, and heat is used to soften the hardened filaments so they can be unwound. Single filaments are combined with a slight twist into one strand, a process known as filature or “silk reeling”. A Silk filament is a continuous thread of great tensile strength measuring from 500 to 1 500 metres in length, with a diameter of 10-13 microns. In woven Silk, the fibre’s triangular structure acts as a prism that refracts light, giving Silk cloth its highly prized “natural shimmer”. It has good absorbency, low conductivity, and dyes easily. Global Silk production rose from around 100 000 tonnes in 2000 to 165 000 tonnes in 2016, thanks to growth of China’s production. China produces about 70% of the world’s Silk, followed by Brazil, India,

Thailand. The unit price for raw Silk is around twenty times that of raw Cotton. **Takihyo**, a Japanese company, has started an Eri Silk project that provides additional income to support cassava farmers in Thailand. The cassava plants are cultivated for their roots, an important source of food, and the leaves of the plants are used to feed the silkworms [14].

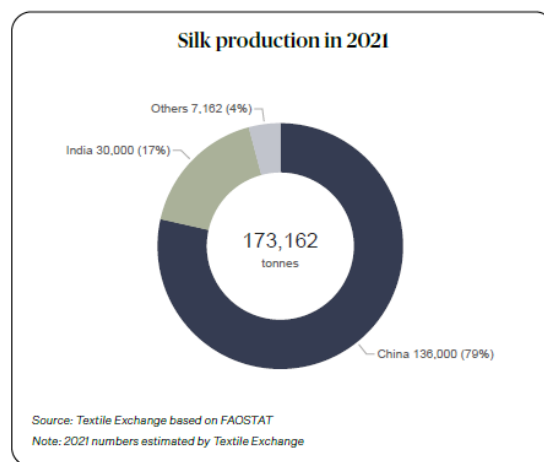


Fig. 7 Silk production in 2021

Manmade Cellulosic Fibers (Virgin, Recycled)

With an annual production volume of around 7.2 million tonnes, manmade cellulosics fibres (MMCFs) had a market share of about 6% of the total fiber production volume. The global MMCF production volume has increased from around 3 million tons in 1990 to approximately 7.2 million tons in 2021. It is expected to further grow in the following years. MMCFs involve viscose, acetate, lyocell, modal, and cupro. Viscose is the most important MMCF, with a market share of around 80% of all MMCFs. Viscose had production volume of around 5.8 million tonnes in 2021. Acetate had a market share of around 13% of all MMCFs with a production of nearly 0.9 million tonnes in 2021. Lyocell was the third most utilized MMCF type after viscose and acetate in 2021. It had a market share of around 4% of all MMCFs in 2021 with a production volume of around 0.3 million tonnes [15]. Modal had a market share of around 3% of the total MMCF market in 2021 with a production of around 0.2 million tonnes. Cupro had a market share of around 0.2% of the total MMCF market. There was only one supplier of cupro producing around

0.02 million tonnes in 2021. Manmade cellulosic fibers are currently primarily produced from wood. Less than 1% is currently made from recycled or other alternative feedstock.

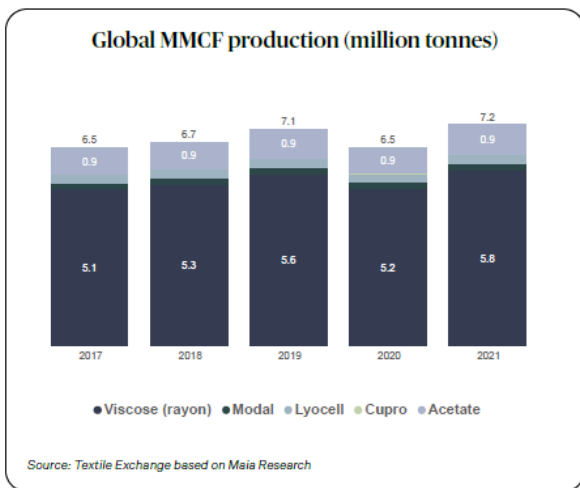


Fig. 8 Global MMCF production (million tonnes)

The market share of “recycled” MMCFs is predicted at around 0.5% of all MMCFs in 2021. But a lot of research and development is still going on. Many of the “recycled” MMCFs are still in development. The first commercially available MMCFs partially or wholly made from recycled materials used mainly cotton linter or pre-consumer cotton textile residues as feedstock. Lenzing’s TENCEL™ Lyocell with REFIBRA™ Technology may be mentioned as the first technology which reclaimed the materials offered on a commercial scale. Refibra™ was presented in spring 2017. While it was initially made with 20% pre-consumer cotton residues, the percentage increased to 30% in 2019. A special lot production including 5% post-consumer waste and 25% pre-consumer waste started and will become the standard product soon. Lenzing’s and Södra’s joint aim is to process 25 thousand tonnes of textile waste per year by 2025 [16].

Polyester, Recycled and Biobased Polyester

Polyester is the most widely used fiber among the world with an annual production amount of 61 million tons. Polyester had a market share of approximately 54% of the global fiber production in 2021. Global recycled polyester (Rpet) fiber production volume increased from 8.4 million

tonnes in 2020 to around 9 million tonnes in 2021. There was a slight increase in the market share of recycled PET fibre from around 14.7% of the global PET production in 2020 to around 14.8% in 2021. Recycled polyester is mainly made from PET plastic bottles. The estimated share for plastic bottles is 99% among all recycled polyester. Recycled polyester can be made from other post-consumer plastics such as ocean waste, discarded polyester textiles or from pre-consumer residues [17].

Another prominent innovation related to polyester is the biobased polyester. The market share of biobased polyester is estimated at around 0.02% of the total polyester production. Biobased polyester has the potential to reduce emissions, but materials must be sourced and managed responsibly to realize this potential. Many biosynthetic materials that exist on the market today are partially biobased; it's important that the industry continues to invest and develop 100% biobased solutions. Far Eastern’s Top Green® Bio PET Filament is one of the good examples of biobased PET filament which is made with 30% biobased feedstock from sugarcane. LYCRA® T400® Eco Made fibre is PET fibre which is a combination of chemically recycled plastic bottles and renewable plant-based resources [18].

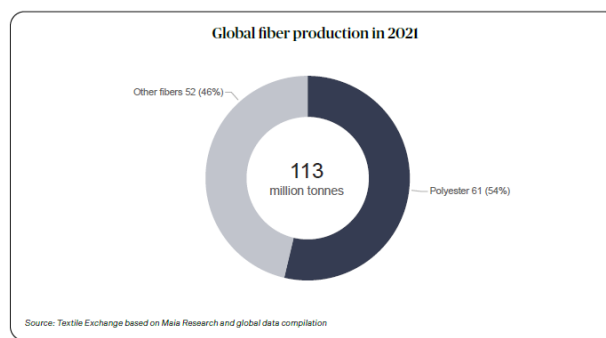


Fig. 9 Polyester production in 2021

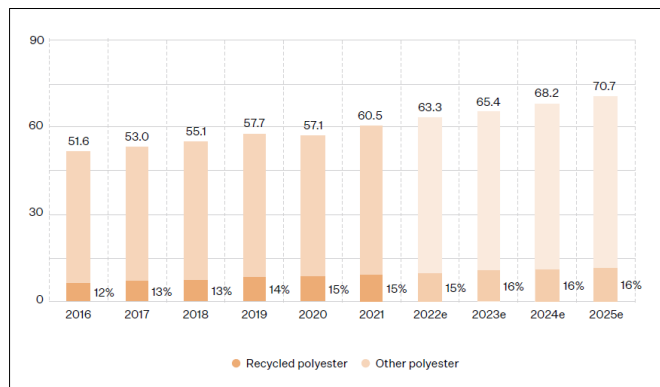


Fig. 10 Polyester production in 2021

Recycled and Biobased Polyamide

The recycled polyamide fibre market is developing with a slow rate due to technical challenges. There are also limitations related to feedstock quality and availability, and low prices for fossil-based polyamide. The market share of recycled polyamide is still very low with accounting for 1.9% of all polyamide production. Pre and postconsumer wastes may be preferred for recycled polyamide. Pre-consumer waste may be processing scraps, fabric cut-offs or hard polyamide waste. Postconsumer polyamide is made from materials such as discarded fishing nets, carpets, or other used textiles. The recycling process can be mechanical or chemical.

The global production amount for biobased polyamide fiber is around 0.02 million tons. It is predicted that the share of biobased polyamide fibers is around 0.4% of the polyamide fiber market [19]. Chainlon's biobased polyamide 6.6 yarn is made with Evonik's VESTAMID® Terra HS® and contains 62% biobased content made from castor oil. Fulgar's EVO® is a 100% biobased polyamide yarn made from castor oil. RadiciGroup's Biofeel® PA is a 64 to 100% biobased polyamide filament yarn obtained from castor oil and agricultural waste (figure 11). Biofeel® nylon includes PA 6.10 yarn and staple fibre, provided from the polycondensation of 1,6-hexamethylenediamine (HMDA) and sebacic acid derived from castor oil plant seeds [20].

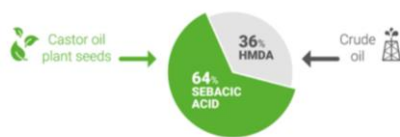


Fig. 11 Biofeel® nylon production [20]

Other Synthetic Fibers

The other synthetic fibers include polypropylene, acrylics, and elastane. This group had a production volume of 5.8 million tons and a market share of around 5% of the global fiber market in 2021. Polypropylene had a market share of 2.7% of the global fiber market in 2021. The polypropylene fiber production volume slightly increased again

from 2.9 million tons in 2020 to 3.0 million tons in 2021, after a slight decrement due to COVID-19 in 2020. It is predicted that just about 0.2% of all polypropylene fibers are recycled. Global acrylics fibre production volumes have been decreasing over the years. The market share of recycled acrylics is estimated at around 0.3% of the total acrylic fibre production in 2021. Global elastane fiber accounts for a market share of around 1% of the global fiber market in 2021. The global elastane fiber production volume growth trend continued in 2021. The share of recycled elastane was nearly 2.6% of the total elastane fiber production volume in 2021. The production volumes of further other synthetics such as polytrimethylene terephthalate (PTT), polylactic acid (PLA), and similar are very low [21].

III. CONCLUSION

This study summarizes some of the important fibre types and their production rates (%) among the world considering new fibre technologies with a sustainable manner. As it is explained above, today more and more brands and producers have turned their faces towards a more sustainable production. The type of raw material has great importance on the final apparel products and determines the place of use. Today cotton, wool, silk and other animal fibres are mainly utilized for apparel products. Around 30-60% of polyester fibres are used for apparel, 20-35% are used for home textiles, and the remaining part for various other applications. Polyamide fibres are used in various applications. A significant share of polyamide fibres is used for home textiles such as carpets as well as technical and industrial applications. Manmade cellulosic such as viscose, lyocell, modal, and cupro are mainly used for apparel with around 50-80% of their production.

It is certain that the share of recycled and biobased fibres will have increased in the following years as the world is moving towards to the pollution-free organic textiles. For a more sustainable, renewable, and ecological textile production, the adoption of organic, recycled, regenerative alternatives should be accelerated. Hence these special textile materials will be soon more accessible with global certifications and standards as well as with industry-wide benchmarking and sourcing standards.

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