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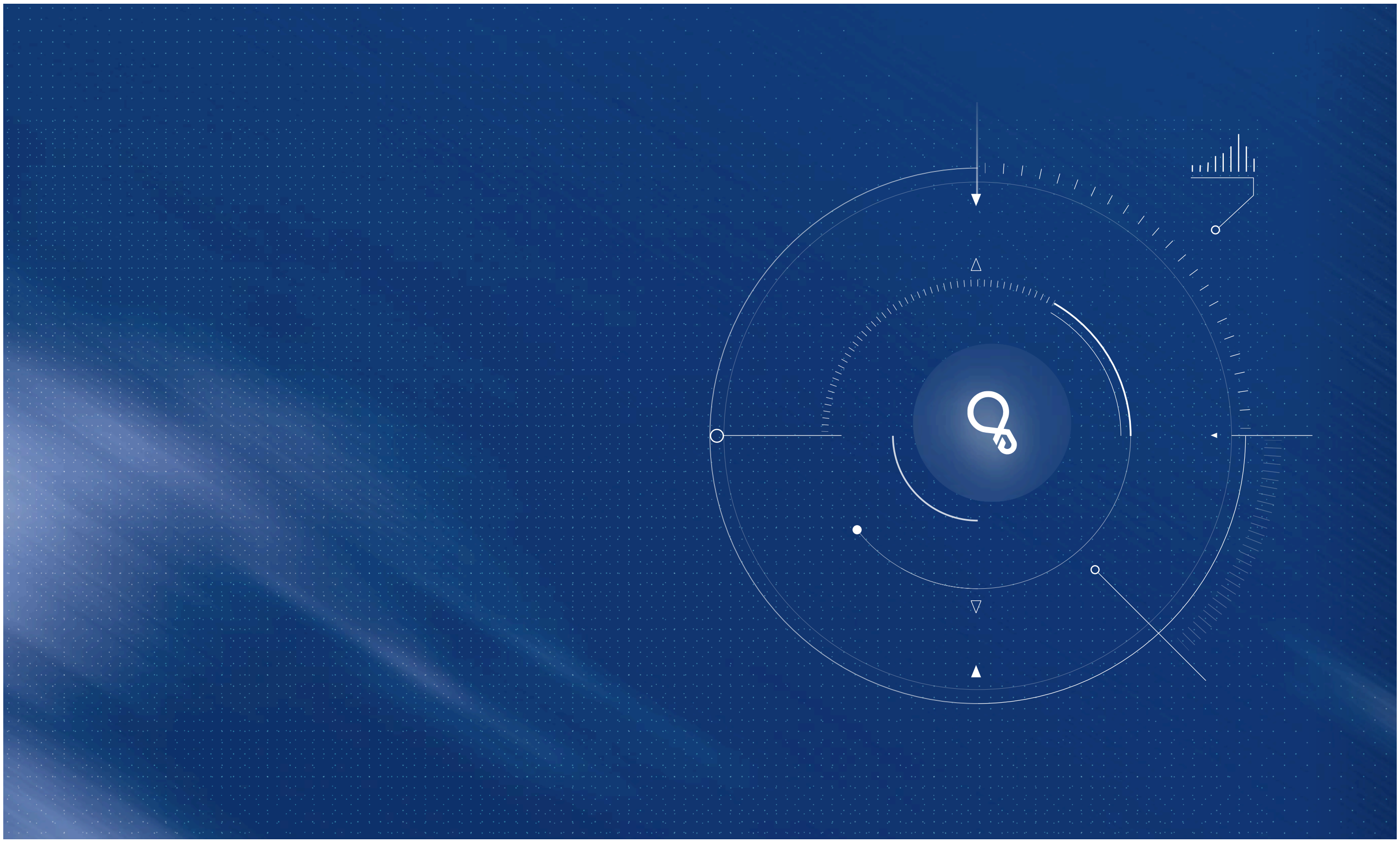

RESEARCH BRIEF

Reducing Microfiber Shedding from Synthetic Textiles

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Cypris Research Brief | For: Open Access
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Table of Contents

Executive Summary

This brief explores the latest innovation and technology solutions that reduce microfiber shedding from synthetic textiles. The data and insights presented in this brief highlight upstream solutions in textile manufacturing, including interventions at the fiber, yarn, fabric, and finishing stages. Innovations in downstream filtration methods, laundering practices, and bio-based fiber substitutions are not included. This structured landscape includes emerging technologies for solution-dyed acrylic or polyester fabrics published globally within the last 3-5 years.

For the solutions identified, an overview of the mechanism of action and key performance data, including durability through laundering cycles and environmental exposure, has been provided. Notes regarding implementation and preservation of key textile attributes, including repellency, cleanability, hand, tensile/tear strength, and colorfastness, have also been provided where available.

Analyst Opinion

Microfiber shedding from synthetic textiles has become a critical issue at the intersection of material science, environmental impact, and product performance. Rather than relying on downstream solutions at the consumer level like improved laundering methods or water filtration, impactful innovations are now emerging upstream at the fiber, yarn, fabric, and finishing stages. This reflects a broader transition toward proactive design, where shedding resistance is engineered directly into the material rather than addressed post-production. New technologies such as self-healing copolymers, core-sheath bicomponent fibers, and low-friction surface coatings are redefining microfiber shedding as a controllable performance parameter rather than an unavoidable byproduct.

Among all manufacturing stages explored, the finishing stage is currently showing the highest density of actionable innovation. Active research shows techniques like enzyme hydrolysis, oxygen plasma treatment, and PDMS-based coatings demonstrate strong microfiber reduction while preserving critical textile attributes. Commercial polymer coating technologies are also surfacing with promising early test results. These processes are intended to be layered onto existing manufacturing workflows and offer a pragmatic path to near-term implementation by textile manufacturers. Digital finishing technologies, such as multiplexed laser surface enhancement, offer an example of innovative development at the finishing stage with potential to transform the industry standard.

Standardized testing of microfiber shedding has advanced in recent years through collaborative initiatives like The Microfibre Consortium. The testing methodology the consortium developed allows textile producers to benchmark shedding performance in quantifiable terms and creates new competitive opportunities for proven low-shed materials. As microfiber performance becomes more measurable, it is becoming a differentiating factor in both sustainability commitments and product development. Overall, this evolving landscape suggests that microfiber shedding is more than an environmental risk to mitigate; it is becoming a driver of innovation, material integrity, and competitive value in synthetic textiles.

Research Methodology

In our research, we utilized the Cypris platform, third-party datasets, and broader internet searches to identify relevant data. Throughout this process, we refined our approach by adapting our keywords to synonyms and related terms to ensure comprehensive data collection within this sector. For our foundational query, we used Cypris' Boolean searching functionality with the following search term:

((all_fields:microfib* AND (all_fields:release OR all_fields:shed)) AND (all_fields:fabric OR all_fields:textile))

Synthetic Textile Manufacturing Overview

Synthetic fibers, including polyester and acrylic, are used broadly in textile manufacturing and have dominated the market since the mid-1990s, accounting for approximately 67% of global fiber production in 2023.[1] Polyester alone had a market share around 57% with approximately 71 tons produced in 2023. Acrylic fibers account for about 1.3% of the global fiber market with nearly 1.6 million tons produced in 2023 (Figure 1). Solution-dyed acrylic fibers are made by mixing color pigment directly into the liquid acrylic polymer before the fiber is formed via a wet spinning process. Colorants are integrated during fiber extrusion of solution-dyed acrylics eliminating the need for subsequent wet processing that can weaken fiber integrity. Solution-dyed acrylic fabrics are preferred in outdoor or contract settings for patio umbrellas, outdoor furniture upholstery, and shade structures due to their durability, weather and ultraviolet resistance, and colorfastness. Polyester is commonly used in healthcare and hospitality industries for items like bed linens, uniforms, and drapery because of its durability and cost efficiency.

The increased global use of synthetic textiles has contributed to growing environmental concerns regarding the release of microplastic fibers into waterways and ecosystems. The widespread presence of microfibers that are released from synthetic textiles during manufacturing and laundering have been shown to have a negative impact on human health and aquatic ecosystems.[2] Microfiber shedding is influenced by upstream manufacturing factors such as fiber type, yarn structure, fabric construction, and finishing processes. Strategies to mitigate shedding at the source include the use of continuous filament yarns instead of staple fibers, tighter fabric constructions, and surface treatments that reduce fiber breakage.[3] Improving the structural integrity of textiles during upstream manufacturing, including the fiber, yarn, fabric, and finishing stages, has potential to mitigate microfiber shedding at the source rather than relying only on downstream consumer-implemented solutions such as filtration during laundering.

[1] "Materials Market Report 2024", Textile Exchange

[2] Carmen Ka Man Chan et al., "Perspective Chapter: Textile Industry Challenges and Priority Actions to Mitigate Microplastic Fibre Pollution," in *Textile Industry and the Environment - Challenges, Recent Development and Future* (IntechOpen, 2025).

[3] Md Imran Hossain et al., "Fibrous Microplastics Release from Textile Production Phases: A Brief Review of Current Challenges and Applied Research Directions," *Materials* 18, no. 11 (2025): 11.

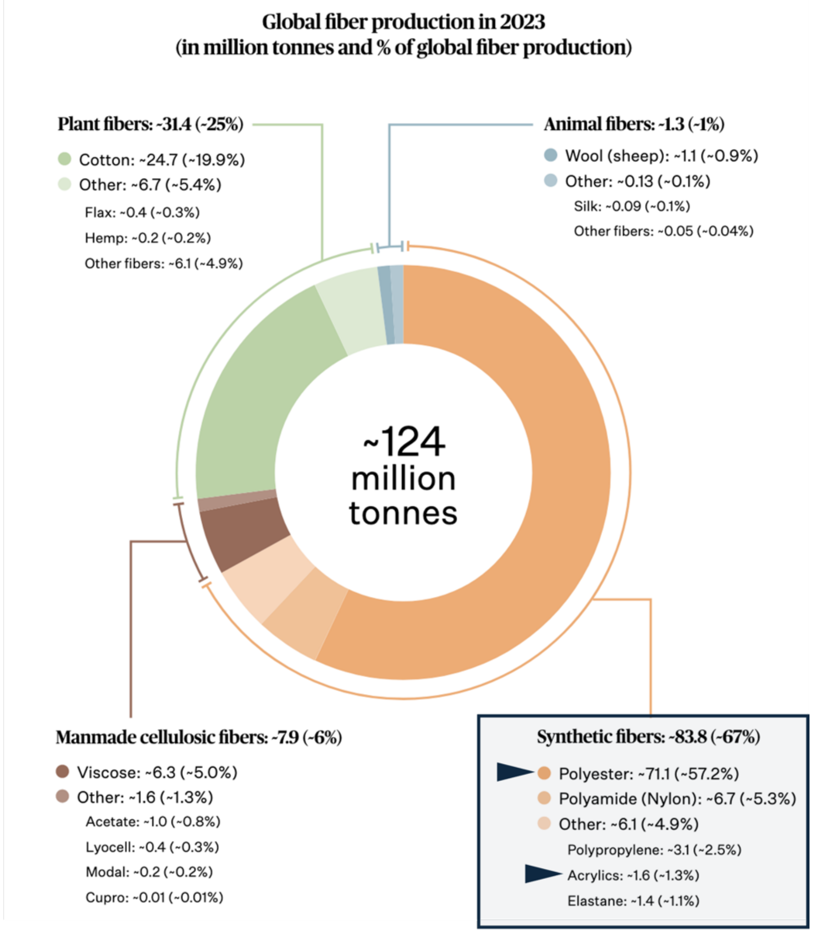

Figure 1: Global fiber production in 2023 (synthetic textiles shown in orange), adapted from Materials Market Report 2024 from Textile Exchange

Standardized Methods to Quantify Microfiber Shedding

The development of standardized testing methods for microfiber shedding has evolved significantly over the past decade in response to growing environmental concerns about synthetic fiber pollution. Initial awareness emerged with studies revealing the widespread presence of microfibers in aquatic environments.[4] However, the lack of consistent testing methods hindered comparative analysis across textiles. The Microfibre Consortium (TMC), formed in 2018, played a key role by uniting stakeholders to create a unified, science-based approach to measuring fiber release.

The TMC Test Method was launched in 2021 and is now a widely adopted standard that enables reproducible measurement of fiber shedding during domestic laundering.[5] This method uses controlled testing protocols and gravimetric analysis to quantify shedding, allowing for consistent cross-product comparisons via the Microfibre Data Portal. The TMC Test Method aligns with other test methods, including AATCC TM212-2021, issued by the American Association of Textile Chemists and Colorists, and the global standard ISO 4484 series, developed by the International Organization for Standardization. These methods are closely aligned with TMC's protocol in terms of laundering parameters, fiber capture, and analysis, providing international consistency. TMC

[4] J. Gago et al., "Synthetic Microfibers in the Marine Environment: A Review on Their Occurrence in Seawater and Sediments," *Marine Pollution Bulletin* 127 (February 2018): 365–76.
[5] "The Microfibre Consortium Announces Public Release of Globally Aligned Test Method to Measure Microfibre Shedding," European Outdoor Group.

has worked collaboratively with both AATCC and ISO to harmonize approaches, ensuring that industry, academia, and regulators can rely on compatible and scientifically robust data to mitigate microfiber shedding of textiles. Cross-sector collaboration has proved crucial in recent years as testing methodologies have continued to evolve, including an innovative method announced by Under Armour in 2023 enabling early intervention to avoid producing high-shed materials.[6]

Innovation Landscape

The innovation landscape for microfiber shedding in synthetic textiles has continued to evolve in recent year and reflects a growing scientific and industrial interest to both environmental impacts and material performance. As shown in Figure 2, publication trends and keyword networks reveal distinct thematic clusters, highlighting the intersection of pollution mitigation, wastewater treatment, and advancements in fiber engineering.

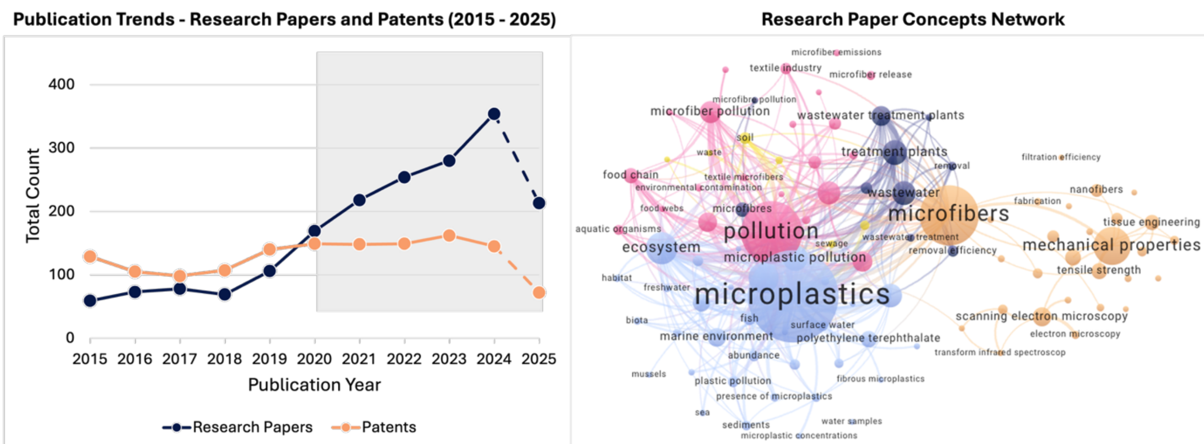

Figure 2: Publication trends in microfiber-related research papers and patents over the last ten years (left) and co-occurrence network for key concepts extracted from relevant research (right).

Fiber Stage Solutions

The fiber-stage of synthetic textile production involves forming filaments from polymers via melt, wet, or dry spinning processes. Most thermoplastics like polyester are processed using melt spinning, where polymer chips are melted, extruded through spinnerets, cooled, and drawn to improve strength. In contrast, acrylic fibers are typically produced by wet or dry spinning, since polyacrylonitrile (PAN) degrades at high temperatures. Fibers are extruded at different lengths and categorized as staple or filament fibers. Staple fibers vary in length and are spun and twisted together to create continuous yarn used to create fabrics. Filament fibers are continuous in length and can be twisted together to form yarn with a smoother surface than yarn from staple fibers. During the fiber stage, properties such as surface smoothness, cohesion, and mechanical strength are defined, making it a critical point for influencing microfiber shedding throughout the life cycle of the textile.[7]

Recent research and patents have focused on modifying fiber composition and surface properties during spinning to reduce microfiber release. In melt-spun systems, polymer additives such as compatibilizers, chain extenders, and softening agents can improve bonding and reduce

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[6] "Under Armour Announces New Methodology to Measure Fiber Shedding," UA Newsroom.
[7] Elisabeth Allen et al., "Microfiber Pollution: A Systematic Literature Review to Overcome the Complexities in Knit Design to Create Solutions for Knit Fabrics," *Environmental Science & Technology* 58, no. 9 (2024): 4031–45.

brittleness in both single-component and bicomponent fibers, including core-sheath technologies, increasing resistance to fragmentation caused by mechanical stress[8]. Fiber-stage strategies address shedding at the polymer level, before yarn formation or fabric processing begins.

Patents

Title: Environmental-friendly fabric and yarn and long fiber thereof
Publication Number: TWM652986U
Publication Date: March 20, 2024
Assignee: DA.AI TECHNOLOGY CO., LTD.
Summary: The patent describes a long fiber composed of a solid portion that features multiple pores, made from a combination of polyester material and porous material, extending in a length direction. By designing the fibers with pores, the fabric effectively disperses force, reducing the likelihood of fiber breakage into microfibers. The polyester is specifically identified as polyethylene terephthalate, which can be derived from recycled plastics that are processed with a modifier. The porous material is specified to be carbon, and the solid portion exhibits a tenacity ranging from 4.5g/D to 3.8g/D, an elongation of 35% or less, and a fineness between 75D and 150D, with the porous material constituting 2% to 8% of the total composition. Additionally, the patent claims a yarn formed by bundling several of these long fibers, with the yarn containing between 72 to 144 long fibers.

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Title: Preparation method of polyester fiber not prone to producing micro-plastics in use process
Publication Number: CN115852519A
Publication Date: March 27, 2023
Assignee: Jiangsu Hengli Chemical Fibre Co., Ltd
Summary: The patent describes a method for preparing polyester fiber that minimizes micro-plastic generation during use. This involves mixing fiber-grade polyester, such as polyethylene terephthalate or modified copolyester, with a self-healing polymer, which is a block copolymer comprising nonionic, ionic polyester, and polysiloxane segments. The preparation process includes melt extrusion, cooling, solidification, oiling, and stretching, with specific parameters for intrinsic viscosity and crystallization enthalpy to ensure optimal fiber properties. The self-healing polymer is synthesized through a series of esterification reactions involving dibasic acids and dihydric alcohols, with precise molar ratios and conditions to achieve the desired properties. The method specifies the proportions of the self-healing polymer in relation to the fiber-grade polyester and outlines the polycondensation steps necessary for final fiber formation. The resulting polyester fiber exhibits enhanced mechanical properties, reduced micro-plastic shedding during washing, and a self-healing capability, making it suitable for applications where environmental impact is a concern.

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Title: Eco-friendly polyester fibers and microfiber shed-resistance polyester textiles
Publication Number: US20210047756A1
Publication Date: February 17, 2021
Assignee: UNIVERSAL FIBERS, INC.
Summary: The patent describes a melt-spun polyester fiber designed to reduce microplastics pollution, available in two forms: (i) a core-sheath bicomponent polyester fiber with a core of poly(alkylene terephthalate) and a sheath of a homopolyester or copolyester containing shed-resistance additives, and (ii) a monocomponent polyester fiber made of poly(alkylene terephthalate) that is partially coated with a shed-resistance coating. The poly(alkylene

[8] Rahul Parakhia et al., Fabric Care Compositions, Methods of Use for Reducing Microfiber Release from Fabrics, and Articles Exhibiting Improved Resistance to Microfiber Release, Patent US2023137685A1, filed October 27, 2022, and issued May 4, 2023.

terephthalate) can include variants such as poly(1,2-ethylene terephthalate), poly(1,3-propylene terephthalate), or poly(1,4-butylene terephthalate), while the sheath may consist of different polyester layers and contain 0.1 to 25 weight percent of shed-resistance additives like lubricants or impact modifiers. The fibers are engineered to minimize fiber weight loss to less than 2 weight percent and waste microfibers loss to under 10 mg per gram after washing cycles. Additionally, the patent covers textiles and articles of manufacture made from these fibers, as well as the method of forming the fibers through melt spinning of poly(alkylene terephthalate). This innovation aims to address environmental concerns related to microplastics by enhancing the durability and performance of polyester fibers in various applications.

Yarn Stage Solutions

During the yarn stage of textile production, synthetic fibers are spun into yarns through either ring, open-end, or air-jet spinning methods. At this stage, modifications can significantly influence the durability and shedding behavior of the resulting textiles. Key interventions to reduce microfiber shedding include using higher twist levels, which compact the fibers more tightly and limit fiber protrusion, and applying low friction finishes or binding agents that enhance fiber cohesion. In addition to twist optimization, yarn compacting techniques and advanced spinning technologies such as vortex or air-jet spinning are gaining traction for synthetic yarns.[9,10] These methods generate smoother yarn surfaces that reduce the likelihood of fiber detachment during use or washing. Implementing these solutions at the yarn stage can significantly mitigate microfiber shedding before the fabric is constructed.

Patents

Title: Production process of circular and sustainable mixed yarns and mixed yarns obtained
Publication Number: US11608573B2
Publication Date: March 20, 2023
Assignee: ANTONIO HERMINIO MARIN
Summary: The patent describes a method for producing a biodegradable and recyclable mixed yarn, which involves several key steps. Initially, at least one continuous filament is placed in a bobbin support and passed through a pair of tensioners, where the tension is adjusted using wing nuts. The continuous filament is then combined with a natural or artificial spun yarn from a spun yarn machine, guided through a collector that houses a compressed air injection nozzle. An insert in the nozzle facilitates interlacing between the continuous filament and the spun yarn, while also removing loosely attached molecules and fibers, including oligomer molecules, which are captured by the collector. The final mixed yarn is wound onto a packing bobbin. The method combines different types of yarns using compressed air injection, allowing for a diverse range of yarn mixtures and weights. The findings indicate that this innovative process not only enhances the variety of sustainable textile products but also significantly reduces the release of synthetic fibers into the ocean, which is a major contributor to environmental pollution.
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Title: Spun yarn with a structure engineered to reduce fiber shedding
Publication Number: US20200385903A1
Publication Date: December 9, 2020
Assignee: Circular Systems S.P.C.

[9] Khurshid Alam et al., "Development and Characterization of Air Jet Vortex Yarn with Novel Fiber Blends," *SPE Polymers* 6, no. 1 (2025): e10158.
[10] Abdul Jabbar and Muhammad Tausif, "Investigation of Ring, Airjet and Rotor Spun Yarn Structures on the Fragmented Fibers (Microplastics) Released from Polyester Textiles during Laundering," *Textile Research Journal* 93, nos. 21–22 (2023): 5017–28.

Summary: This patent introduces a system for reduced fiber shedding that includes various types of composite yarns, specifically rotor-spun and jet-spun wrap-spun yarns. These yarns can incorporate filament wraps with structures based on air-textured yarn (ATY) or air-covered yarn (ACY), which may consist of biodegradable and non-biodegradable multi-filament yarns. The claims further detail configurations of single-cover and double-cover structures, emphasizing the composition of core and outer-cover yarns, as well as the inclusion of thermally recycled polymer fibers.

Fabric Stage Solutions

At the fabric stage, textile manufacturers are exploring several effective strategies to reduce microfiber shedding from synthetic textiles. Research shows that fabric structure plays a pivotal role: woven fabrics, particularly those with dense, long-fiber construction and advanced weave patterns (e.g. orthogonal or interlock weaves), shed less fiber than typically looser knit fabrics, with standard weft knits shedding more than tight warp knits.[11] A key innovation in this space is 3D knitting, which creates highly engineered, seamless structures that encapsulate insulating fibers within pocket-like yarn constructions. Polartec® Power Air™ is an innovation which uses a 3D knit construction to encase lofted fibers inside individual air pockets, reducing fiber shedding by up to 80%.[12] Comparative studies also show that brushed finishes, which increase surface fiber exposure for softness, significantly elevate shedding, whereas unbrushed or singed surfaces result in less fiber release during wear and laundering.[13]

Patents

Title: Insulating double-knit fabric
Publication Number: US11725310B2
Publication Date: August 14, 2023
Assignee: MMI-IPCO, LLC
Summary: The patent describes an insulating, double-knit fabric consisting of two knit layers that are interconnected through spaced rows in two perpendicular directions, creating a grid of air pockets. These air pockets are filled with intermediate fiber regions that contain multi-filament fibers aligned parallel to the knit layers. The fabric features a denier gradient, where either the first or second knit layer has finer yarns compared to the other, and both layers may consist of various materials including polyester, polypropylene, and modacrylic fibers. These intermediate fiber regions provide insulation and trap air for thermal efficiency, while eliminating fiber breakdown that causes microfiber shedding during washing.

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Title: Low shedding bonded fleece
Publication Number: TW202140880A
Publication Date: October 31, 2021
Assignee: PRIMALOFT, INC.
Summary: The patent describes a fabric with a monolithic woven structure featuring a process front and back, where the front has raised hairs formed by loop yarn extending vertically from binding yarn containing adhesive fibers. This design minimizes the risk of the fabric's components detaching. The claims further specify that the pile yarn can be knitted with the binding yarn, may create a raised surface on the back side, and consists of polymer fibers, particularly synthetic

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[11] Onchanok Juntarasakul et al., "Weave Structures of Polyester Fabric Affect the Tensile Strength and Microplastic Fiber Emission during the Laundry Process," *Scientific Reports* 15, no. 1 (2025): 2272.
[12] SJ Guest Editorial, "Polartec Continues to Innovate Polartec® Power Air™ with 3D Knit Structures," *Sourcing Journal*, August 11, 2022.
[13] Yaping Cai et al., "The Origin of Microplastic Fiber in Polyester Textiles: The Textile Production Process Matters," *Journal of Cleaner Production* 267 (September 2020): 121970.

types like polyester and nylon. The binding yarn can be made from single or two-component adhesive fibers, available in filament or staple forms, with specific Denier values and weight percentages of adhesive fibers.

Finishing Stage Solutions

At the finishing stage of textile manufacturing, after dyeing and before the final treatments, various mechanical and chemical processes are applied to improve the performance and appearance of fabrics. For synthetic textiles, finishing methods such as enzyme hydrolysis or chitosan and alkali treatments have shown strong potential in minimizing fiber fragmentation. Enzyme hydrolysis works by breaking down surface fibrils, smoothing the fabric and reducing the likelihood of fiber release during washing. Similarly, chitosan or alkali treatments chemically modify the fiber surface to reduce loose or protruding fibers. Both methods have demonstrated significant reductions in microfiber shedding over repeated laundering cycles.

In addition to chemical treatments, physical and surface modification techniques are gaining traction. Oxygen plasma treatment alters the fiber surface by increasing roughness and wettability, which helps reduce fiber dislodgement. Another promising strategy involves applying polydimethylsiloxane (PDMS) brush coatings, often preceded by plasma priming, to create a low-friction, protective layer that inhibits fiber loss. Emerging commercial finishes also aim to encapsulate yarn bundles and prevent mechanical breakdown during wear and washing. In addition to mechanical and chemical finishing, a novel digital finishing process has been developed by PANGAIA and MTIX to mitigate microfiber shedding.[14] PANGAIA and MTIX won the Microfiber Innovation Challenge powered by Conservation X Labs in 2022 for their novel application of MTIX's multiplexed laser surface enhancement (MLSE®) technology to modify the surfaces of fibers to reduce shedding.[15]

Research Papers

Title: Enzyme hydrolysis of polyester knitted fabric: A method to control the microfiber shedding from synthetic textile
Publication Date: June 22, 2022
Author(s): Rathinamoorthy Ramasamy, Raja Balasaraswathi Subramanian
Institution(s): PSG INSTITUTE OF TECHNOLOGY AND APPLIED RESEARCH
Abstract: Synthetic textile materials are noted as one of the major contributors to microfiber release from household laundry. The higher usage of synthetic textiles was noted as one of the major reasons for the leaching of microfibers into the aquatic system. Though few laundry aids are available to control the release of microfiber from laundry, no successful methods were developed to control it in the fabric itself. Hence, this research aimed to analyze the effectiveness of surface modification of polyester fabric using lipase enzyme and its impact on microfiber shedding. Taguchi's L9 orthogonal array was adopted to optimize the enzyme treatment process parameters to reduce microfiber shedding. The results showed that enzyme concentration was the major influencing factor with a contribution of 35.56%, followed by treatment pH (35.247%), treatment time (17.46%), and treatment temperature (11.74%). The optimization with S/N ratio showed minimum microfiber shedding at an enzyme concentration of 0.5 gram per liter (gpl), treatment temperature of 55°C, 6.5 pH, and a treatment time of 45 minutes. Knitted polyester fabric treated with the optimized enzyme treatment condition showed a significant reduction ($p<0.05$) in microfiber shedding (count-79.11% and mass-85.68%). The surface changes and the interaction of

[14] "MTIX Ltd. Completes First Phase of Installation of MLSE® Platform for PANGAIA."
[15] "PANGAIA x MTIX Microfiber Mitigation," Microfiber Innovation Challenge.

the enzyme on the fabric were confirmed by hydrolytic activity and FTIR analysis. The optimized treatment on different knit structures and fabric with different grams per square meter (GSM) indicated the versatility of the treatment irrespective of fabric parameters. The repeated laundry process (20 washing cycles) showed that the enzyme-treated samples had a significant level ($p<0.05$) of reduction in shedding than the control sample. The difference in shedding after 20 washes supports the efficiency and longevity of the enzyme treatment process in reducing microfiber shedding.

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Title: Oxygen plasma treatment to mitigate the shedding of fragmented fibres (microplastics) from polyester textiles
Publication Date: December 1, 2024
Author(s): Abdul Jabbar, Michael Bryant, Joshua Louis Armitage, Muhammad Tausif
Institution(s): University of Leeds, National Textile University, University of Birmingham Edgbaston
Abstract: The release of fragmented fibres (FFs) during the manufacture and service life of textiles is one of the key sources of microplastic pollution. Polyester (polyethylene terephthalate (PET)) is the most widely used fibre with production volume of 63 million tonnes - represents 55% of all textile fibres and 80% of synthetic fibres. The impact of textile material and structural variables as well as chemical modification of textiles to mitigate the release of FFs has previously been reported. For the first time, the current research brings together disciplines of textile technology and tribology to understand the impact of inter-fibre friction on the release of FFs. The oxygen plasma, a sustainable alternative approach to chemical treatment methods, was employed to alter the surface morphology and consequently the frictional behaviour of fibre surfaces and eventually its impact on the release of FFs. Using commercially relevant methods, bespoke polyester fabric was manufactured and treated with low pressure oxygen plasma. The treated and untreated samples were characterised for surface roughness (fibre surface profilometry), coefficient of friction (nanotribometer), FFs shedding, shear properties and wettability. An increase in surface roughness of polyester fibres was observed after the treatment. The oxygen plasma treatment significantly increased the coefficient of friction, shear hysteresis, wettability and reduced the FFs shedding by 43 % in mass (accumulative of prewash and 5 accelerated washes) and 73 % in count (number) compared to untreated sample, without impacting the fabric handle and imparting hydrophilic property. Strong negative correlations between shed FFs and fabric coefficient of friction ($r = -0.907$ for FFs mass and $r = -0.918$ for FFs count) were observed. The outcomes of this study confirm that the fibre tribological properties can play a role to modulate the release of FFs from polyester textiles, using a sustainable method of plasma treatment technology.

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Title: Liquidlike, Low-Friction Polymer Brushes for Microfibre Release Prevention from Textiles
Publication Date: March 26, 2024
Author(s): Sudip Kumar Lahiri, Zahra Azimi Dijvejin, Farzan Gholamreza, Sadaf Shabanian, Behrooz Khatir, Lauren Wotherspoon, and Kevin Golovin
Institution(s): University of Toronto and University of British Columbia
Abstract: During synthetic textile washing, rubbing between fibres or against the washing machine, exacerbated by the elevated temperature, initiates the release of millions of microplastic fibres into the environment. A general tribological strategy is reported that practically eliminates the release of microplastic fibres from laundered apparel. The two-layer fabric finishes combine low-friction, liquidlike polymer brushes with “molecular primers”, that is, molecules that durably bond the low-friction layers to the surface of the polyester or nylon fabrics. It is shown that when the coefficient of friction is below a threshold of 0.25, microplastic fibre release is substantially reduced, by up to 96%. The fabric finishes can be water-wicking or water-repellent, and their comfort properties are retained after coating, indicating a tunable and practical strategy toward a sustainable textile industry and plastic-free oceans and marine foodstuffs.

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Title: Effect of surface modification of polyester fabric on microfiber shedding from household laundry

Publication Date: September 16, 2022

Author(s): Rathinamoorthy Ramasamy, Raja Balasaraswathi Subramanian

Institution(s): PSG INSTITUTE OF TECHNOLOGY AND APPLIED RESEARCH

Abstract: Synthetic textile materials are noted as one of the major contributors to microfiber pollution through laundry. Though many research works evaluated microfiber pollution, the solutions provided to control microfiber shedding are meager. The existing products collect or filter the microfiber from laundry effluent and restrict the direct leaching. However, no methods were proposed to effectively reduce the shedding from the textile itself. This research is aimed to analyze the influence of surface modification of polyester knitted textiles by sodium hydroxide, on microfiber shedding. Response surface methodology was adapted to optimize different treatment parameters (alkali concentration, treatment time and temperature). The results show that the sodium hydroxide concentration and treatment time had a negative correlation with microfiber shedding reduction. Whereas, treatment temperature had a positive correlation with microfiber shedding reduction. The statistical analysis revealed that 0.4 M concentration, 90°C temperature and 24 min of treatment time was the best process condition for minimum microfiber release. The same was confirmed with a practical experiment and a significant reduction of 80.63% in microfiber shedding after alkali treatment was found. Alkali treatment of different knitted polyester fabrics with various knit structures and mass per square meter showed a significant reduction in microfiber shedding. The repeated laundry performed for 20 washes with surface-modified samples showed a significant reduction in microfiber release at every wash cycle and ensured the longevity of the effect.

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Title: Impact of Chitosan Pretreatment to Reduce Microfibers Released from Synthetic Garments during Laundering

Publication Date: September 9, 2021

Author(s): Heejun Kang, Saerom Park, Bokjin Lee, Jaehwan Ahn, and Seogku Kim

Institution(s): Korea Institute of Civil Engineering and Building Technology, University of Science and Technology (Korea)

Abstract: Sewage treatment can remove more than 90% of microplastics, yet large amounts of microplastics are discharged into the ocean. Because microfibers (MFs), primarily generated from the washing of synthetic clothes, are the most abundant type of microplastics among various microplastics detected in the sewage treatment, reducing the amount of MFs entering these treatment plants is necessary. This study aimed to test whether the amount of MFs released from the washing process can be reduced by applying a chitosan pretreatment to the garments before washing. Before the chitosan pretreatment, the polyester clothes released 148 MFs/L, whereas 95% of MFs were reduced after the chitosan pretreatment with 0.7% of chitosan solution. The chitosan pretreatment was applied to other types of garments, such as polyamide and acrylic garments, by treating them with 0.7% of chitosan solution; subsequently, MFs reduced by 48% and 49%, respectively. A morphology analysis conducted after washing revealed that chitosan coating on the polyamide and acrylic were more damaged than on polyester, suggesting that the binding strength of polyamide and acrylic with chitosan was weaker than that of polyester garment. Thus, the results suggested that the chitosan pretreatment might be a promising solution for reducing the amount of MFs generated in the laundering process.

Patents

Title: Coating for reducing microplastic shedding in textile, coated textile and method of preparing same
Publication Number: US20250145835A1
Publication Date: May 7, 2025
Assignee: THE GOVERNING COUNCIL OF THE UNIVERSITY OF TORONTO
Summary: The patent describes a textile coating composition that includes a primer and a polymer brush. The primer, which bonds to the textile surface, is defined by a general formula where R can be various functional groups such as amine, alkoxy, or mercapto, and is selected from alkyl, aryl, or siloxane. The polymer brush, which bonds to the primer, consists of a polymer with an oxygen-containing backbone and a glass transition temperature below 20°C. Specific examples of primers and polymers are provided, including various silanes and poly(ethylene glycol). Additionally, the patent outlines a coated textile that features a primer layer and a polymer brush layer, with the primer exhibiting similar characteristics as described in the composition. The coated textile is noted for its low friction coefficient and compatibility with a range of textile materials such as nylon, polyester, and cotton. A method for forming the coated textile is also included, detailing the deposition of the primer and polymer brush layers through various techniques such as dipping or spraying, ensuring the final product maintains the desired properties.

Products

Polygiene (headquartered in Sweden)

- **ShedGuard™**: In-development textile finishing compound that forms a polymer sheath around fiber bundles to reduce microfiber release during washing. This polymer technology is currently being tested to the AATCC TM 212 standard. Early tests have shown microfiber shedding reduction up to 70% for knits and between 15-30% for wovens.

Livinguard Technologies (headquartered in Switzerland)

- **Livinguard Better Fresh (BF)**: An odor control technology combined with an innovative mechanism that reduces fiber fragmentation and shedding up to 80% according to company reports.[16]

[16] "Livinguard Launches Innovative Technology to Combat Mounting Microfiber Pollution from Textiles," EIN Presswire, July 16, 2025.

Comparative Tables of Solutions

The following set of tables provide a comparative overview of the microfiber-shedding reduction technologies identified across the fiber, yarn, fabric, and finishing stages. Each solution is summarized based on its mechanism of action, applicable textiles, reported performance, durability, impact on textile attributes, and implementation considerations.

Fiber Stage Solutions

Technology/ Intervention	Mechanism of Action	Applicable Textiles	Performance	Durability	Impact on Textile Attributes	Implementation Considerations
Core-Sheath Bicomponent Fibers	Dual polymer layers (strong core with protective outer sheath)	Polyester	Up to 45% reduction of microfiber release	High; tested 30-cycle wear and laundering	None noted	Expected compatibility with existing fabrication, dyeing, and finishing processes; interfacial adhesion between layers is critical
Continuous Filament Fibers	Filaments reduce breakage compared to staple fibers	Polyester, Acrylic	Higher strength, durability, and tear resistance compared to staple fibers	High; minimal fiber loss over time	Less breathable and moisture-absorptive compared to staple fibers	May involve bulk texturizing or twisting to achieve desired fabric hand
Self-healing Block Copolymer	Self-healing behavior repairs fiber microdamage during use, reducing microfiber shedding	Polyester	50–95% reduction of microfiber release (varies by formulation)	High; maintains mechanical properties and fiber strength under repeated washing and mechanical stress	None noted	Good compatibility with a spinning polyester melt

Yarn Stage Solutions

Technology/ Intervention	Mechanism of Action	Applicable Textiles	Performance	Durability	Impact on Textile Attributes	Implementation Notes
Air-jet (Vortex) Spinning	Compressed air nozzles create vortex-based wrap twist; airflow wraps outer fibers around core	Polyester, Acrylic	Minimal yarn hairiness for reduced fiber loss	Increased abrasion and pill resistance	Less soft hand-feel compared to ring-spun yarn	Requires longer staple fibers for optimal cohesion
High Twist Yarn	Higher twist factor binds individual fibers tightly, increasing fiber cohesion	Polyester, Acrylic	Lower hairiness and smoother surface for reduced fuzz and pilling	Increased wear resistance	Increased tensile strength and abrasion resistance; stiffer hand feel compared to low-twist yarns	Optimal twist level is critical for performance; requires steam or heat setting for stabilization

Fabric Stage Solutions

Technology/ Intervention	Mechanism of Action	Applicable Textiles	Performance	Durability	Impact on Textile Attributes	Implementation Notes
Tight Weave/Knit	Maximize thread or stitch density resulting in a compact fabric structure with less protruding fiber ends	Polyester, Acrylic	Significantly lower fiber release compared to loosely constructed fabrics	Increased dimensional stability and long-lasting structure	Less soft hand-feel and lowered absorbency compared to loosely constructed fabrics	Requires optimization for balanced density to avoid increased rigidity
3D Knitting (Polartec® Power Air™)	Enclosed fibers protected from abrasion; inner air pockets trap heat and minimize fiber exposure	Polyester	Up to 80% reduction of microfiber shedding	Maintains integrity and lofted structure through laundering cycles	Highly breathable; consistent thermal performance	Higher set-up costs; requires specialized equipment for computer-aided design and manufacturing

Finishing Stage Solutions

Technology/ Intervention	Mechanism of Action	Applicable Textiles	Performance	Durability	Impact on Textile Attributes	Implementation Notes
Polymer Brush Coating	Polymer brushes form a low-friction, smooth fiber surface at the nanoscale	Polyester	Up to 96% reduction in microfiber shedding	Maintained coating through five laundering cycles	Retains breathability, flexibility, tactile softness, and water repellency	None noted
Enzyme Hydrolysis	Lipase enzyme hydrolyzes exposed surface polymer chains, reducing fraying and loose fibers	Polyester	80-85% reduction in microfiber shedding	Maintains performance after 20 washing cycles	None noted	None noted
Oxygen Plasma Treatment	Low pressure oxygen plasma treatment to increase surface friction and hydrophilicity reducing relative fiber motion and breakage	Polyester	Over 40% reduction in microfiber shedding	Maintains shedding performance after pre-wash plus 5 laundering cycles	Increased repellency	Plasma exposure time and power require optimization
Alkali Treatment	Surface hydrolysis of polyester chains via alkali deweighting to remove loose surface fibers	Polyester	Up to 89% reduction for woven fabrics and 68% reduction for knitted fabrics	Sustained reduction in microfiber shedding over 20 laundering cycles	None noted	Studies highlight up to 95% reduction in fiber release for alkali treatment in combination with chitosan,

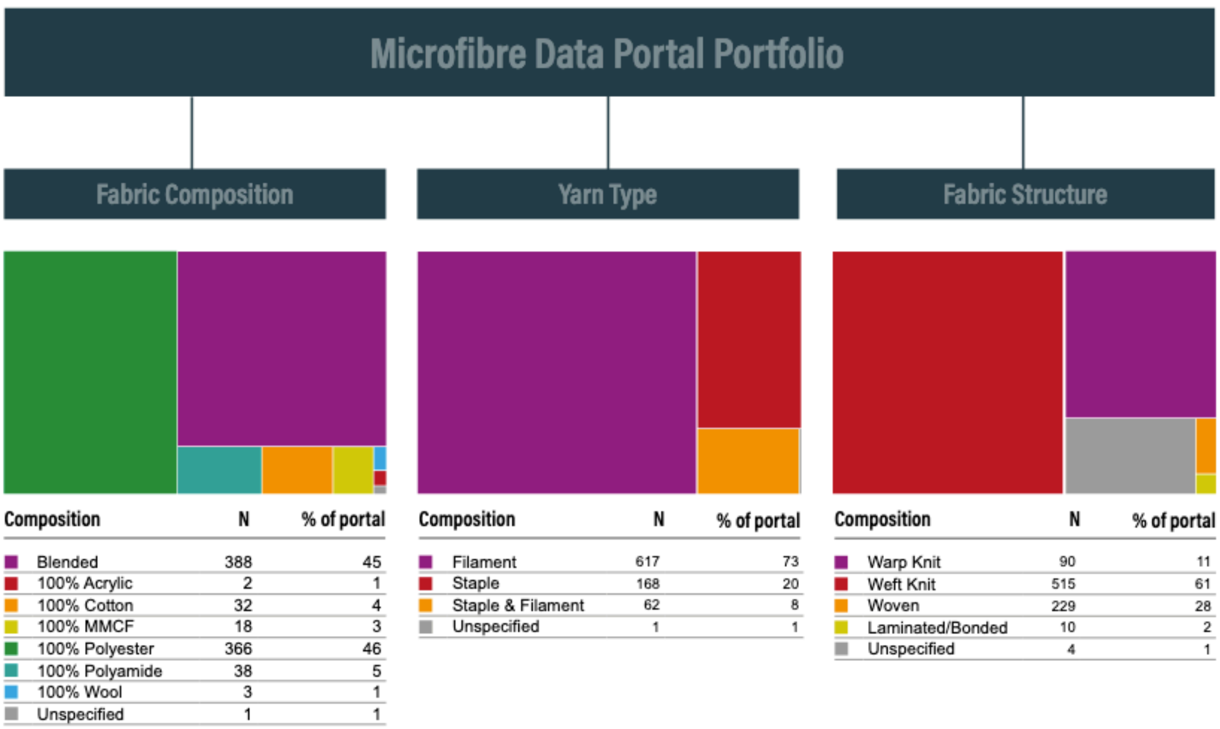
						sericin, or polyvinyl alcohol finishes[17]
Chitosan Treatment	Polymer film forms a cohesive layer to bind surface fibers and reduce fragmentation	Polyester, Acrylic	95% reduction of microfiber release from polyester; 49% reduction from acrylic	Coating was maintained through 3 washing cycles for polyester; coating partially peeled off for acrylic samples	Increase in fabric stiffness	Optimal chitosan concentrations for acrylic require additional research
Polygiene ShedGuard™	Unique blend of polymers forms a film around yarn bundles preventing separation of fibers during wear and laundering	Polyester	Up to 70% reduction in microfiber release from knits and 15-30% reduction for woven fabrics	Currently being tested to the AATCC TM 212 standard	Minimal impact on hand feel; does not affect colorfastness or repellency	Developed with compatibility with existing textile finishes
Livinguard Better Fresh (BF)	Water-based polycationic polymer finish imparts a permanent positive charge on fibers and wraps polymer chains around fiber bundles to reduce fragmentation	Polyester	Up to 80% reduction in microfiber release	Maintained performance through 10 washing cycles	Improved odor control	Dual-function finish improves odor-control and reduces microfiber shedding

[17] Rathinamoorthy Ramasamy and Raja Balasaraswathi Subramanian, "Microfiber Mitigation from Synthetic Textiles - Impact of Combined Surface Modification and Finishing Process," *Environmental Science and Pollution Research International* 30, no. 17 (2023): 49136–49.

Leaders in Cross-Sector Innovation

The Microfibre Consortium

The Microfibre Consortium (TMC) is a nonprofit organization established to drive the textile industry toward practical solutions to reduce microfiber shedding through science-led, collaborative action. The consortium includes over 80 global members across the textile supply chain, including prominent brands like Patagonia and Under Armour as well as academic and nonprofit partners. In efforts to work towards zero impact from fiber fragmentation of textiles to the natural environment (The Microfibre 2030 Commitment), TMC developed the TMC Test Method to standardize the measurement of fiber shedding during laundering and manages the Microfibre Data Portal, a secure, centralized platform that aggregates microfiber shedding data from signatory organizations to support research, innovation, and regulatory alignment. As of May 2024, the data portal contained testing data for over 800 fabrics tested with the TMC method (Figure 3). By fostering open data sharing and consistent methodologies, TMC plays a pivotal role in translating scientific insights into industry-wide progress.



Composition	N	% of portal
Blended	388	45
100% Acrylic	2	1
100% Cotton	32	4
100% MMCF	18	3
100% Polyester	366	46
100% Polyamide	38	5
100% Wool	3	1
Unspecified	1	1

Composition	N	% of portal
Filament	617	73
Staple	168	20
Staple & Filament	62	8
Unspecified	1	1

Composition	N	% of portal
Warp Knit	90	11
Weft Knit	515	61
Woven	229	28
Laminated/Bonded	10	2
Unspecified	4	1

Figure 3: The Microfibre Data Portal Portfolio, Image Source: The Microfibre 2030 Commitment Progress Update (June 2024)