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Contents

High-speed spunlace line

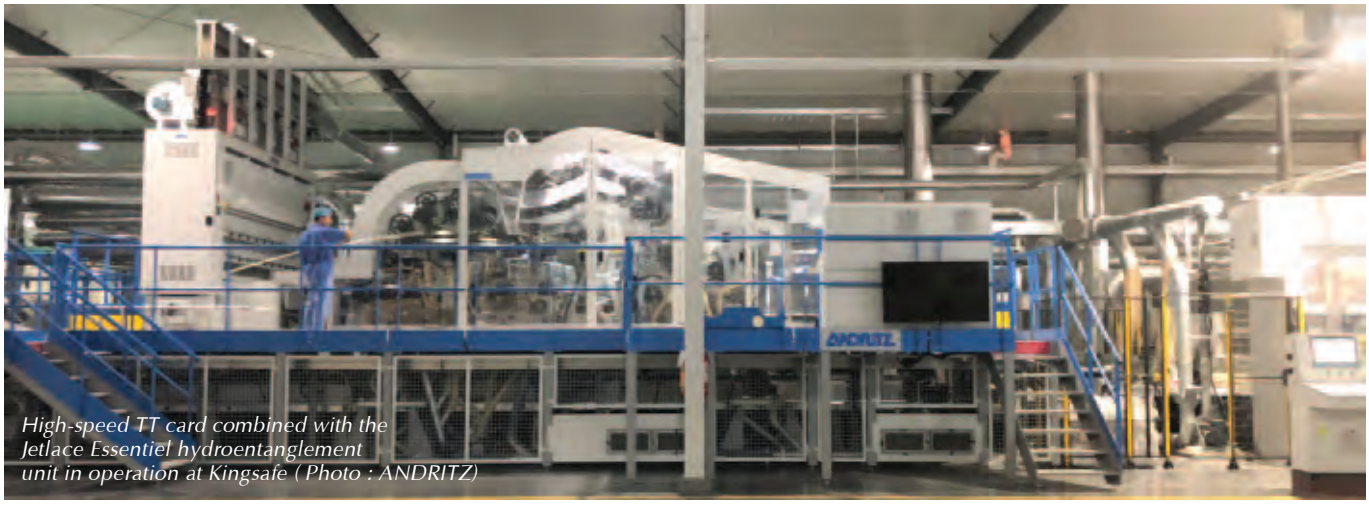
International technology Group ANDRITZ has received an order from Zhejiang Kingsafe Hygiene Materials Technology Co., Ltd. in Hezhou, China, to supply a complete new neXline spunlace line. The line is scheduled for installation and start-up during the second quarter of 2022.

This high-capacity spunlace eXcelle line will process either 100% biodegradable fibers or blends of polyester and viscose. It is dedicated to the production of hygiene and medical fabrics. The final products will have fabric weights ranging from 30 to 100 gsm, and the annual production capacity will be up to 18,000 tons.

ANDRITZ will deliver a complete line, from web forming to drying, also integrating two high-speed TT cards, the well-known Jetlace Essentiel hydroentanglement unit and the neXdry through-air dryer equipped with a neXecodry S1 system for energy saving. This combination is becoming the market benchmark for the production of lightweight spunlace fabrics dedicated to the hygiene market.

'We are proud to operate ANDRITZ nonwoven lines, which are very reliable and efficient. It helps us a lot in producing top-of-the-range, nonwoven roll goods, thus enabling us to be recognized as a key player among nonwovens producers worldwide,' says Kingsafe's president, Mr. Huarong Yan.

Zhejiang Kingsafe Hygiene Materials Technology Co., Ltd., founded in 1987, is one of the largest companies in China producing spunlace and spunbond nonwoven roll goods, with several spunlace lines already in operation. The final products are exported all over the world and used in many fields, such as the medical sector, health care, high-tech agriculture, and high-quality consumer and household products.



High-speed TT card combined with the Jetlace Essentiel hydroentanglement unit in operation at Kingsafe (Photo : ANDRITZ)

IDEA spotlights post-pandemic global trends

INDA, the Association for the Nonwoven Fabrics Industry, will highlight global and regional insights from industry thought leaders on the future of nonwoven and engineered materials supply, production capacity and demand at the triennial IDEA conference program March 28-31, 2022, in Miami Beach, Florida.

The conference program will address the pandemic impacts on the global nonwoven supply chain and recovery for China, South America, Asia, North America, and Europe from a diverse group of presenters from Fitesa, INDA, EDANA, China Nonwovens and Industrial Textiles Association (CNITA), and Asia Nonwoven Fabrics Association (ANFA).

IDEA22 is a major industry event for Nonwovens & Engineered Fabrics and is expected to attract more than 6,500 senior-level delegates and 500 exhibitors from myriad industry sectors, including absorbent hygiene, wipes, filtration, medical/surgical products including PPE (personal protective equipment), home & office furnishings, transportation, geosynthetics and building construction sectors from over 60 countries. The 2022 event marks the 21st anniversary of IDEA, with the show originating in 1971.

During the show, the IDEA Achievement Awards will honor brilliant innovations in the nonwovens and engineered materials industry across six categories. INDA, in partnership with Nonwovens Industry magazine will jointly present the awards with emcee hosts Dave Rousse, President of INDA and Rod Zilenziger, President/Owner of Rodman Media Corporation.

The new line is now the ninth spunlace line supplied by ANDRITZ and the third with high-speed TT cards, thus confirming the successful, long-term partnership between ANDRITZ and Zhejiang Kingsafe. The order also proves that the solution provided by ANDRITZ is recognized as the benchmark for production of premium spunlace roll goods and contains the perfect combination for wipes converting machines.

Archroma celebrates successful market start

Archroma, a global leader in specialty chemicals towards sustainable solutions, announces a successful first year on the U.S. home care market with its whiteness solutions for laundry and detergents.

Archroma acquired in December 2019 the BASF's stilbene-based optical brightening agents (OBA) business for liquid and powder laundry detergent applications. The acquisition included the OBA technology, portfolio and manufacturing unit at Ankleshwar, India.

Since then, Archroma has mobilized its global experts, technologies and know-how, to design a holistic solutions portfolio for household, industrial & institutional cleaning (HI&I) aimed to support detergent manufacturers.

The portfolio now includes solutions for whiteness, coloration, stain removal, fabric softening, as well as sequestering agents and surfactants, which can be used in applications such as multipurpose cleaning powders, detergent powders, dish wash tablets and liquids, laundry liquids and fabric softeners, and hard surface cleaners.

Archroma used its experience working with manufacturers and brands in the textile industry to enter the US detergent markets for the very first time, and has been able to gain a significant position with most key laundry detergent manufacturers with its solutions for whiteness.

Bryan Dill, Head of Sales, North America, at Archroma, said, 'We are extremely proud of our progress with our whiteness solutions for laundry and detergents in North America. Of course, such success is built upon Archroma's decades of OBA expertise in many other applications like textile and paper, but we couldn't have done that without the trust of the major detergent brands who selected our product performance and our know-how.'

ATI develops mask test adapter

Air Techniques International (ATI), a designer and manufacturer of specialised testing equipment for filters and masks, has introduced a new mask test adapter for testing personal protective equipment (PPE).

The adapter is for use with ATI's 100X automated test filter and is an airtight fixture that securely holds cup and duckbill style masks commonly seen with N95, KN95, FFP, and P100 respirators in place, while allowing aerosol to enter the adapter and test the mask according to industry standards.

ATI's 100X mask test adapter is used for quality assurance tests of its high-performance filtration masks. The design protects the mask during testing and can be cleaned and reused in less than five minutes.

The new ATI mask test adapter provides the flexibility to test a variety of mask designs and sizes. The acrylic material is easy to clean and reusable. The company said its goal was to design an affordable high quality, versatile adapter. The result is a durable adapter that can withstand thousands of test cycles if handled and maintained properly.

Coats extends range of sustainable threads

Coats, the supplier of industrial threads widely used in the knitting sector, has developed EcoRegen, a biodegradable thread which supports customers' looking to increase their commitment to sustainable production.

Coats EcoRegen is made from 100 per cent lyocell, a renewable fibre derived from wood pulp sourced from sustainably managed forests. This eco-friendly regenerated fibre is fully biodegradable and compostable due to its cellulosic origin and is suitable for a wide range of apparel applications to accommodate multiple customer needs.

The launch of EcoRegen is part of Coats' Eco Journey roadmap to produce innovative sustainable products which support the company's drive towards a circular economy. This journey started with EcoVerde in 2018, which is now said to be one of the most comprehensive ranges of 100 per cent recycled polyester threads, zips and trims on the market.

There are a further two new products which will be launched soon: EcoCycle is a range of water dissolvable thread that facilitates garment recycling and end-to-end circularity; and Eco-B is a recycled polyester thread incorporating an additive which reduces synthetic fibre accumulation in landfills and microfibre pollution in oceans.

All these sustainable and circular threads offer superior sewing performance and excellent quality.

Denim jeans production returns to Europe

This autumn, C&A will open the Factory for Innovation in Textiles (FIT) in Mönchengladbach, Germany, to develop next-generation sustainable fashion, beginning with denim jeans.

The brand is working with the

Niederrhein University of Applied Sciences, the Textile Academy NRW, RWTH Aachen University and various start-up companies on the implementation of FIT.

It will integrate highly automated processes in the sewing room and laundry and together with the Textile Academy NRW, C&A will hire and train around 100 co-workers to work at the CO_2-neutral site. Initially, around 400,000 pairs of jeans per year will be produced in Mönchengladbach, to be expanded to 800,000 at a later stage.

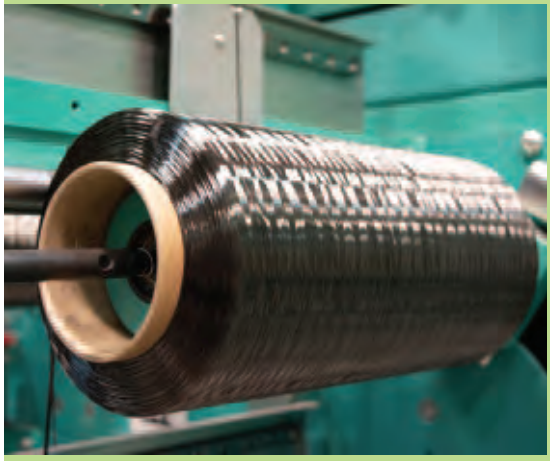
C&A has set new standards in denims in recent years - in 2018 the company developed the world's first jeans with Cradle to Cradle (C2C) Gold-level certification, and in 2020 its Beluga jeans achieved C2C Platinum certification. The first denim jeans resulting from FIT will be available in 2022.

'Together with our partners, we want to set new standards in textile manufacturing,' said Giny Boer, CEO of C&A Europe. 'We are thrilled to be producing in the heart of Europe again. C&A's FIT will combine the digitalisation of processes with sustainability, creating new standards for global production. It will be more than just a lab for prototypes. It's about producing in larger quantities, because sustainable fashion cannot just be a niche product.'

Hexcel to build a new Center of Excellence

The Utah Governor's Office of Economic Development (GOED) has announced that Hexcel Corp. (Stamford, Conn, US) will build a flagship Center of Excellence for Research & Technology (R&T) to support next-generation developments in advanced composites technologies in Utah, adding up to 150 new high-paying jobs in the next 12 years.

'We welcome Hexcel as it expands in Utah,' says Dan Hemmert, GOED's executive director. 'Their decision to grow here will create many high-paying jobs for Utahns in skilled science and advanced technology. Hexcel also has an excellent training program that will serve to develop Utah's workforce further and help its employees develop the skills they need to succeed.'



Hexcel is a global advanced composites technology leader, manufacturing carbon fiber, woven reinforcements, resins, prepregs, honeycomb and additive manufactured parts for customers in commercial aerospace, space and defense and industrial markets. According to the company, this new R&T center will be the company's largest center for innovation and product development in North America and a showcase for the company's advanced composites technology, providing space for future growth and expansion in the years ahead. The company's existing operations in West Valley City, Utah, include what Hexcel contends is its largest high-performance carbon fiber manufacturing facility in the world. The site is also home to the company's US aerospace matrix operations. About 600 people currently work at the site.

'We are grateful for the support that Utah continues to provide to Hexcel, and we are excited to announce this investment in innovation today to ensure our continued leadership tomorrow,' said Nick Stanage, Hexcel chairman, CEO & president. 'This new site will provide much-needed room to expand our research, to broaden our portfolio and to offer our customers an enhanced opportunity to collaborate with us on the latest composite technology developments for aerospace, space and defense and industrial applications.'

3D technology to drive knitting machine market

The global knitting machines market is expected to show a compound annual growth rate of 27.4 per cent up to 2026, driven by a growing demand for advanced 3D knitting technology, automation and artificial intelligence capability.

A new report from Global Industry Analysts Inc shows that the market is estimated at 58.9 thousand units in 2020, and is projected to reach 260.7 thousand units by 2026.

China constitutes the largest regional market for knitting machine sales, the report notes, accounting for 80.4 per cent of the global sales in 2020 while the rest of the world is poised to register the fastest compounded annual growth rate of 28.8 per cent over the analysis period, to reach 2,7 thousand units by the close of the analysis period.

Amid the COVID-19 crisis, the global market for the overall textile machinery market is estimated at 5.9 million units in the year 2020, and is projected to reach a size of 10.1 million units by 2026, displaying at a CAGR of 9.1 per cent over the analysis period.

According to the report, ever-changing fashion trends are creating a continuous demand for newer textiles, which generates demand for textile machinery, that creates specialized effects on fabrics. Demand is also high for machines that perform specific tasks such as mercerizing, which is a process for increasing shimmer and strength of cotton.

Spinning machines, one of the segments analyzed in the report, is projected to record a 7.6 per cent CAGR to reach a market size of approximately 8.8 million units by the end of the analysis period. After a thorough analysis of the business implications of the pandemic and its induced economic crisis, growth in the Draw Texturizing Machines segment is

projected to spiral at 18.6 per cent CAGR for the next 7-year period.

The report also notes that a key ongoing trend in the market is the continued automation of machinery. Adoption of robots allows manufacturers to expedite production cycles, reduce labour costs, push safety, improve quality, and drive notable gains in terms of efficiency and productivity. Artificial intelligence also holds special significance in supporting textile manufacturing and helping companies achieve high efficiency, accuracy and continuity in production systems and equipment.

Eastman expands capacity to produce Naia cellulosic yarn

To serve rapidly growing customer demand, global specialty materials provider Eastman is increasing its capacity to produce Naia™ filament yarn at its Barcelona, S.L., site by 30% by mid-2021 and more than 50% by the end of 2022.

'The growing importance of sustainability and circularity as key market drivers is accelerating adoption of sustainable fibers. As a result, Naia™ cellulosic filament yarn is gaining a lot of traction among our customers,' said Burt A. Capel, Eastman vice president and general manager of fibers.

'Our vision is to make sustainable fashion accessible to all, and we have a very committed team at our Barcelona site actively working to bring this expansion onstream as soon as possible to serve our customers across the globe,' Capel added.

The expansion will support new brand adoptions of Naia™ in womenswear fashion, where there is a growing demand for sustainable fibers.

Returnity partners with New Balance

Returnity, a California-based reusable packaging solution provider announced the deployment of reusable shipping packaging for New Balance's Team Sports initiative, resulting in a more reliable and environmentally sustainable solution for sending and receiving samples.

New Balance is a leading uniform supplier to schools and clubs around the country as one of America's largest sports footwear and clothing brands, necessitating a rigorous sample shipping process.

CEO of Returnity, Mike Newman, said the use of single-use packaging hit an all-time peak in 2020. Creating a more circular environment necessitates ingenuity, and with this new initiative, New Balance has proven its leadership in reducing waste and adding value to its consumers.

New Balance will ship sample sports jerseys and boots in antimicrobial-coated Returnity reusable bags and boxes to keep apparel, footwear, gear, and textiles fresh and lasting longer. This recycled packaging would replace hundreds of single-use cardboard boxes used by coaches during the athletic season, furthering New Balance's goal of providing a more comfortable and reliable experience for coaches while eliminating waste.

Top and leggings in Sensitive Fabrics certified LYCRA SPORT Technology, with seamless construction and Dream Neon decorative motifs by FRAMIS ITALIA.

Sensitive Fabrics with Lycra Sport technology

Activewear goes beyond the gym and provides elegance, charm and well-being. Lifestyle is moving on, no longer formal clothes but garments that follow the shapes, needs and desires of the wearer. This emerging trend is fully reflected in the collections from the most innovative fashion brands and has a perfect ally in the proposals of Sensitive Fabrics, certified with cutting-edge Lycra Sport technology.

Designed to satisfy the demands of high-specification sportswear, Sensitive Fabrics with Lycra Sport technology are a unique source of creative inspiration for contemporary luxury activewear.

The innovative Sensitive Fabrics system is a Eurojersey patent. A product of Made in Italy excellence with an exclusive textile construction that includes a high percentage of Lycra premium fibre, it offers a unique range of weights, prints and finishing.

High-breathability and lightweight Sensitive Fabrics with Lycra Sport certification are tested to provide forefront benefits for the wearer - extra comfort, exceptional fit, targeted support and total freedom of movement.

Lycra Sport certification - known and valued by activewear brands throughout the world - is based on a unique scientific method of measuring fabric performance, based on a combination of Comfort, Power and Energy indexes. A valuable technology for the most innovative fashion creations.

INDA launches updated material sampler & guide

Professionals in nonwovens and engineered materials will now have the latest nonwoven material options at their fingertips with the launch of INDA's Nonwoven Material Sampler & Guide, a unique educational and technical resource with 124 material samples to touch and compare.

Updated, in its sixth edition, this valuable educational tool presents the latest innovations, processes, and types of materials now available to professionals involved in developing, specifying, designing, purchasing, and processing nonwovens.

A new batt forming line for stitchbonding

International technology Group ANDRITZ has received an order from Pratrivero s.p.a. to supply a new eXcelle batt forming line for their production facilities in Valdilana, Italy. The line will be dedicated to the production of Maliwatt products, used in furnishing, automotive, naval, medical, geotextiles, advertising, clothing, and packaging applications. Installation and start-up are scheduled for the third quarter of 2021.

ANDRITZ eXcelle crosslapper (Photo: ANDRITZ")

The ANDRITZ batt forming line includes an eXcelle card and eXcelle crosslapper, a ProDyn™ web profiling correction system as well as a scanning gauge with a closed loop. The ProDyn system combines actions from the card doffers with dynamic speed variation at the crosslapper. This will result in substantial fiber savings and reduction in CV%, providing improved weight evenness in the final product. The ProDyn closed loop will ensure the best possible self-regulation for the equipment and thus enable Pratrivero to produce one of the best product qualities on the market. Pratrivero will be the world's first company to use the ProDyn technology in the Maliwatt stitchbonding process.

Stitchbond is a nonwoven process made by mechanically interlocking fiber webs with continuous filaments, thus imitating textiles. Stitchbonded products are used in many applications due to their lower production costs compared to woven textiles. Among all the different nonwoven processes in which it operates, ANDRITZ is also a market-leading supplier of batt forming equipment for the stitchbonding processes producing Maliwatt, Malivlies and quilting.

Pratrivero has trusted in ANDRITZ once again because of its reputation regarding process expertise and high level of carding and crosslapping technology involved. The company already operates several ANDRITZ eXcelle batt forming units.

Pratrivero is an important player in the production of nonwoven fabrics using stitchbonding technology. The company has several plants in Italy and the USA, producing different types of stitchbonded products. The centuries-old tradition of the Italian company, founded in 1663, combined with modern technology has enabled Pratrivero to bring stitchbonding to a high-end quality level with unique characteristics.

The 178-page publication contains more than double the material swatches from the prior Sampler as well as educational content on the nonwoven processes and 38 illustrations.

'We are pleased to release the newest and more comprehensive edition of the Nonwoven Material Sampler & Guide that serves as a valuable visual and tactile tool for discussions and comparisons of nonwoven materials,' said Dave Rousse, INDA President. 'Using this educational resource will help project teams evaluate material solutions for their needs, make more informed decisions, and bring new products to market faster and more efficiently.'

The insightful guide details nonwoven processes and definitions, typical end-uses, and processing steps and benefits, making it ideal for both industry newcomers and more experienced professionals in product development, engineering, design, sales, and marketing.

It also provides an overview of the markets, products, processes, web formation, bonding technologies, weights/grams per square meter, raw materials, and bonding methods in an easy-to-digest overview format.

Project teams using the Sampler & Guide can easily examine the different web formations, bonding techniques, fibres/resins used, and basis weights, to understand the differences between each of these unique materials. The samples included in the book are representative of the nonwoven industry processes in a wide range of weights/grams per square meter, from 4 gsm to 1700 gsm.

Kvra launches pilot collection with Polygiene technology

The gi is the traditional uniform for jiu-jitsu, a popular martial art in many countries, including Brazil.

It is made from a thick fabric, and the wearer tends to sweat heavily when performing. A typical gi can take as long as two days to dry after being in the laundry, leading many users to purchase two or three so they can be wearing one while the other is being washed and dried.

Brazilian brand Kvra is the first company in the world to offer jiu-jitsu gis treated with Polygiene Stays Fresh technology and believes it will enable athletes to use the same uniform multiple times.

Polygiene Stays Fresh technology provides odour control by inhibiting the growth of odor-causing bacteria and stops the odor at the source. It therefore reduces the number of times a product needs to be washed, saving energy, time and money.

Kvra is launching a focused pilot collection called Ashes of Creation with Polygiene which is expected to lead to high annual orders, as well as the potential use of the technology in its other collections of clothes for mixed martial arts and CrossFit.

A number of jiu-jitsu athletes have tested the new gis and were highly impressed.

'Working together with Kvra makes

total sense and we are excited to be a part of a movement to extend the life of apparel and enhance the user experience,' said Polygiene CEO Ulrika Björk. 'The combination of Kvra and Polygiene will be a game-changer for those using these gis and we couldn't be more excited to be part of the first-in-the-world launch of this collection and the opportunity this brings to this sport, as well as karate, judo and taekwondo, going forward.

LiveSmart Evolve range from Culp

Culp, based in High Point, North Carolina, reports that since the introduction of its LiveSmart Evolve fabric range in 2019, it has helped divert over 63 million plastic bottles from waste streams by incorporating Repreve recycled fibre into its upholstery and mattress fabrics.

LiveSmart Evolve is made with at least 30% Repreve, a high-quality polyester yarn made by Unifi from recycled post-consumer plastic bottles.

Due to the pandemic and an increased consumer focus on the safety and comfort of the home, Culp has seen strong interest across its LiveSmart portfolio of performance fabric products, including Outdoor, Ultra, Barrier Plus and Evolve.

The company has worked to strongly promote its LiveSmart Evolve line as a product that builds on the stain-resistance and cleanability of its performance fabrics offering environmentally-conscious consumers the ability to be a part of positive change to conserve natural resources.

'Culp is grateful to have such a strong relationship with Unifi, and the use of Repreve in our upholstery fabrics has been a phenomenal success,' said Tammy Buckner, senior vice-president of marketing and design for Culp Upholstery Fabrics. 'At least 80 per cent of plastic

flows into the oceans from land, totalling over eight million tons per year, but we've worked to turn this negative into a positive through our LiveSmart Evolve range. Demand for fabrics with a sustainability focus has been propelled during the pandemic. It is no longer just words, but consumers are taking action to make sure their home purchases reflect their own commitment to bettering the environment. By incorporating Repreve yarn into our fabric, we are working to reduce the plastic problem before it enters our landfills, rivers and oceans.'

Culp also continues its focus on developing additional products designed for environmental sustainability, including mattress fabrics designed with certain recycled and biodegradable content.

Techtextil and Texprocess 2022: registration now open

The Techtextil and Texprocess trade fairs have a positive view of the future and invite the sector to take part at Frankfurt Fair and Exhibition Centre from 21 to 24 June 2022. Exhibitors who register well in advance benefit from an early-booking discount.

The dates for the next editions of Techtextil and Texprocess have been set and the leading international trade fairs for technical textiles and nonwovens and for the processing of textile and flexible materials are set to attract exhibitors and trade visitors from all over the world to Frankfurt am Main from 21 to 24 June 2022. Thus, the fairs are shifting the biennial cycle of events from odd to even years, which fits in perfectly with the sector's international event calendar. Companies that book exhibition space at one of the two trade fairs no later than 31 August 2021 benefit from an early-booking discount. 'We see the future in a positive light and are confident that we will finally be able to give the sector the opportunity to meet and exchange ideas and information in June 2022. The desire for personal encounters, direct communication and new impressions is growing from day to day,' said Olaf Schmidt, Vice President Textiles and Textile Technologies.

Elgar Straub, Managing Director, VDMA Textile Care, Fabric and Leather Technologies, said, 'Texprocess and Techtextil are the world's foremost trade fairs for our innovative sector by a large margin.'

'Both events offer customers an unrivalled overview of state-of-the-art innovations and technological developments - and beyond. Particularly when it comes to the latest trends for sustainability and digitalisation, Texprocess and Techtextil in Frankfurt represent the most important, future-oriented market. This makes it all the more important for both the exhibitor and visitor sides of the sector that we have the opportunity to obtain an overview of the latest market developments, to exchange ideas and information and to initiate new business. We are very relieved about this and hope that, next year, we will once again have the chance to generate new momentum for our sector in the international market.'

For the first time, Techtextil and Texprocess will occupy the western sector of Frankfurt Fair and Exhibition Centre with a total of four exhibition halls and, with a hybrid format, offer the best of both the physical and immaterial worlds: personal communication, virtual

New Eco Brights collection from ELeather

Made with recycled fibres from chopped up waste leather shavings that are normally sent to landfill, ELeather is now employed as a seating material by over 200 airlines and in thousands of trains and buses.

It is 40% lighter than conventional leather and manufactured by a patented process adapted from the conventional nonwoven production routes. This involves first altering and grinding the waste leather trimmings and split hides to produce individual leather fibres before they are laid in air and consolidated with high pressure water jets.

Design for Good is the UK company's brand and online resource hub dedicated to the design community and its latest material collection is Eco Brights, featuring a palette of seven washed out colours and corrugated textures aimed at highlighting the need to repurpose and recycle whenever possible.

'Growing awareness of over-consumption and the need for sustainable thinking was the main inspiration behind this collection,' said ELeather's designer Nicky Fox, 'The colours and textures reference the fragile nature around us and highlight the need to protect it. Design must be built to last and to allow for more repurposing and recycling'.'

Eco Brights consists of seven colours that can work together or individually, and includes three different grains, including a smooth metallic. From neutral Dune to pink Sorbet and dark Cactus, the collection targets many markets and applications - from public spaces to lifestyle and tech items.

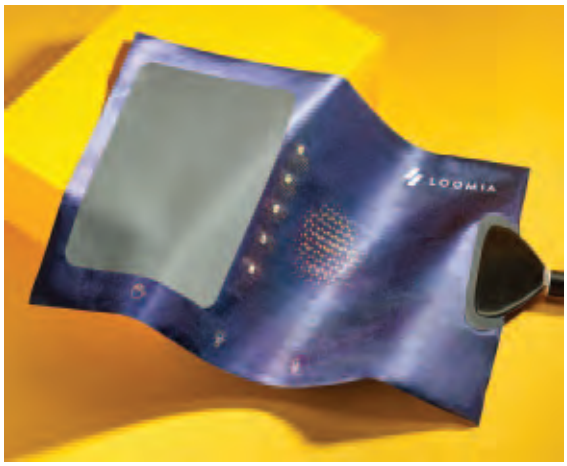
Each roll of material is made with up to 55% recycled leather and in addition, the production of ELeather materials results in an up to 60% reduction of CO2 and uses up to 55% less water compared to the production of traditional leather.

networking opportunities and maximum digital coverage. With a comprehensive hygiene and safety concept, Messe Frankfurt will ensure that all visitors and exhibitors can take part safely and with a good feeling.

Automotive inroads for Loomia

Loomia has partnered with the Global Alliance Automotive (GAA) to promote the use of soft circuit technology in the automotive industry.

Loomia's patented e-textile technology is a soft, flexible, customisable circuit that



can be embedded into automotive fabrics such as PU leather, wood veneer and knits and wovens. The technology can provide lighting, user interfaces, sensing and heating for interiors and is distinguished by easy to customise components and lightweight integration.

'We've been excited by how the automotive industry has embraced our electronic-textile technology and working with GAA will allow us to reach more customers in it,' said Madison Maxey, CEO of Loomia. 'We think that the organisation's expertise paired with our patented technology can make an impact on automotive interiors.'

'Loomia's soft circuit systems are a game-changer for the automotive industry,' added Ralf Mueller, GAA Managing Director. 'There are 3D touch/HMI/heating/lighting solutions on the market already, but the fact that Loomia is able to combine several functions in one soft circuit system offers our customers on the OEM and system supplier level a freedom of choice and tailoring which is outstanding. The fact that in the end the circuit system can be used as a soft, flexible and robust fabric is adding extra advantages compared to other individual solutions available on the market.'

Laser cutting for foam products

As precise as foam can be processed with traditional technologies, cutting alone rarely gets the job done. CNC milling creates small plastic crumbs that are spread over the work surface or gradually contaminate the tool. Punching machines exert a lot of pressure on the material and often cause material distortion or unclean cut edges. In addition, the production of individual cutting dies is associated with additional costs. Water jet cutting allows the production of filigree structures and precise edges but leaves residues of liquid on the material. Either way, additional quality control or post-processing processes are required after cutting, which are more or less complex depending on the product.

The extent to which conventionally made-up foam has to be reworked depends not only on the method used but also on the composition and above all on the pore structure of the starting material. Open-cell foams are air- and water-permeable, making them ideally suited for storing liquids. During the assembly in the water jet process, however, the material absorbs moisture along the cut edges and must first be dried before final processing can begin. Contactless material processing by a laser cutter not only makes post-processing irrelevant but also meets the highest quality requirements for the use of foam products in sensitive areas.

Mayser GmbH & Co. KG from Lindenberg in the Allgäu is one of the leading providers of such materials. Founded more than two centuries ago as a hat maker and still active as a fashion label, the group of companies now focuses on the areas of safety technology, foam technology, and molded parts production. Foams developed by Mayser can be found in the interior of cars, as sound absorbers in machines and air conditioning systems, or are used to seal measuring instruments and medical devices. The respective workpieces have to meet high quality requirements in some cases, which usually requires additional work steps when assembling with classic cutting processes and ultimately causes higher production costs.

To find out whether laser cutting is also suitable for various foam products of the INDUCON® brand, Mayser commissioned eurolaser to carry out an extensive series of tests. Based on an elastomer made of polyurethane (PUR), INDUCON® products can be equipped with specific properties using various manufacturing processes. As a mixed-cell compression foam, a thermally compressed PUR flexible foam, the material is used to manufacture spacers for machines or vehicles, as an anti-slip covering for office

Foam or plastic, textiles or wood : the modular system XL-1600 from eurolaser allows the processing of a wide variety of materials on a single machine without significant modifications

Fully recycled new Jack Wolfskin fleece

Jack Wolfskin's latest DNA Hike collection features a three-layer fabric made entirely from recycled materials.

It consists of Polartec Windbloc recycled synthetic fabrics in the outer and inner layers as well as a waterproof and breathable Texapore Ecosphere membrane which is also made from recycled materials.

The DNA Hike collection is based on Wolfskin's iconic styles from the archives which have been redesigned and updated with the latest sustainable technologies.

The classic Gecko fleece sweater, which has been a bestseller for Wolfskin since 1995, will also be available as a fully recycled product from next winter.

The brand has used Malden Mills Polartec fabrics in its collections since 1988 and in 1999 the Polartec Recycling collection - one of the very first on the market - was introduced and grew to become a staple in Jack Wolfskin clothing.

This year, Polartec is also celebrating the invention of fleece material 40 years ago.

furniture or medical devices. Open-cell products can be used as filters or liquid storage. The common features of all INDUCON® variants include high resistance to chemical substances (including solvents), good insulation properties, and high elasticity.

New Jakob Müller website

One of the world's leading machinery suppliers has just launched its new website - in which the company's renowned technology is firmly relegated to a back seat. Instead Jakob Müller Group is offering a fresh and innovative web experience which sets out its priorities with total clarity.

Of course, Jakob Müller is known worldwide as a manufacturer of systems and solutions for narrow fabric production. Its research, development and production of top technology has evolved continuously since its foundation in 1887. Innovation has always been at the core of this success story, based on recognition of customer needs and demands. And that customer focus now takes centre stage in the completely reconceived website.

The concept aims to take visitors to www.mueller-frick.com instantly into a familiar world.

This welcome to Jakob Müller Group might be a surprise. But it signals the group's wish to become part of the customer's whole world, showing how it already empowers countless products used, without a second thought, in everyday life. The design concept uses discreet visual hints to point up awareness of some of these items we often take for granted.

Fashion, home textiles, automotive, medical and industry - all these are fields in which Jakob Müller helps to shape the future. And these sectors are used as anchors for website orientation, with red frames guiding the visitor through the wide application ranges. At a single click, users can find the best way to manufacture a specific product. Professionals in the narrow fabrics and ribbon industry can access detailed information on every aspect of their work. The range spans yarn warping to the finished product, crochet knitting to woven labels, and individual machines to complete system solutions.

Spinnova develops textile fiber from waste leather

Spinnova, a sustainable natural material firm, and KT Trading, the leather partner of premium shoe brand ECCO, have collaborated to launch a fiber made from leather waste: Respin. Respin's pilot-scale manufacturing will begin at the end of 2021, with the natural durability of leather and the lightweight feel of a conventional textile.

The textile industry is still on the lookout for modern, environmentally friendly, and circular fabrics. Spinnova and KT Trading have succeeded in manufacturing a raw leather cloth made from leather waste that is free of toxic chemicals after extensive research and testing.

CEO of KT

Trading, Kristian Geert Jensen, said leather is a fantastic, high-quality material with its own set of characteristics. They've taken another step toward achieving the circular economy for leather with this new textile.

Spinnova has established the Respin company, a new joint venture with KT Trading, ECCO's main leather supplier. In Finland, the companies are currently building a pilot plant for the manufacture of leather fibers.

Janne Poranen, Spinnova's CEO and co-founder said they're overjoyed to be able to complete the leather circle with their mates. This is about more than up-cycling; it's all about developing a promising new material that the industry has been waiting for. This is also an example of how they have a technology that can work with a variety of different feedstocks.

Since 2018, ECCO's Applied Research division and Spinnova have been working together on R&D and have completed promising trials spinning protein biomass into the fiber. Spinnova does not need to create any new technologies to process leather raw material. The firm has already shown that the process works on wood-based raw materials.

Toray expands thermoplastic composites capabilities

Toray Advanced Composites has announced the expansion of its thermoplastic composite material capabilities for high-performance applications, with the introduction of a next-generation, high-heat laminate press at the company's Nijverdal facility in the Netherlands.

This expansion in capability advances the supply of Toray Cetex reinforced thermoplastic composite laminates (organosheets) for high-temperature performance applications across resin systems including PEEK, PEKK and LMPAEK. Toray says the press can consolidate up to 400°C. Laminates are available with woven fabric, uni-directional (UD) and hybrid reinforcement configurations.

Further, laminates made using the high-temperature press are reported to be 50% larger than existing laminates in this performance category. According to the company, the increased size broadens the adoption of high-performance thermoplastic composite materials to include larger part geometries across both aerospace and industrial applications.

Toray Cetex laminates are fully consolidated in the press, eliminating the need for secondary layup and consolidation stages, and enabling efficient and cost-effective high-volume fabrication of high-performance, high-quality thermoplastic composite parts. The laminates also undergo rigorous quality inspection to ensure near-zero voids.

'This announcement is an exciting step in our strategic expansion of thermoplastic technology,' says Frank Meurs, managing director of Toray Advanced Composites. 'Building on over 30 years of heritage and innovation within our Cetex thermoplastics, this unique capability underlines our continuing commitment to invest in the future needs of large-scale adoption of thermoplastic composites in an affordable way.'

Toray Advanced Composites' high-heat laminate press (Photo Credit: Toray Advanced Composites)

Cinte Techtextil China's annual and hybrid edition

Taking place from 22 - 24 June at the Shanghai New International Expo Centre, this year's Cinte Techtextil China marks the first edition since the fair switched from a biennial to an annual event. And following the success of last year's hybrid fair, exhibitors and visitors unable to attend the in-person event in Shanghai will be able to participate virtually with a range of options available.

The move to an annual event provides more opportunities for suppliers to take advantage of the surging demand in the global market for nonwovens, particularly in the medical and personal hygiene sectors. This is especially so in China, where 1.25 million tons of nonwovens were exported in 2020, up 31.6% on the previous year. These goods totalled USD 4.58 billion in value, a year-on-year increase of 62.6%.

Exhibitors and buyers alike were eagerly anticipating the switch to an

annual Cinte Techtextil China at last year's edition. 'It's great that the event will be held annually starting from 2021, which will provide us with more opportunities to meet with different leading suppliers,' said Ms Zheng Xiaoqin, Material Engineer at Hyundai Motor Company. Mr Sean Sun, Sales Manager of Graf + Cie AG's Chinese subsidiary, which will exhibit again at this year's fair commented, 'Making this fair an annual one brings only benefits. This is the perfect platform for displaying products and exposing our brand to a wider audience. We can interact with potential clients and establish new contacts.'

Cotton Council International, Tiandingfeng Nonwovens, CHTC Jiahua Nonwoven, Foshan Nanhai Beautiful Nonwoven, Zhejiang Kingsafe Hygiene Material Technology and Hi-Tech Heavy Industry are also participating this June.

Techtextil in Germany and Cinte Techtextil China are teaming up to launch an online platform, Techtextil Digital Days @ Cinte Techtextil China 2021, to allow exhibitors and buyers to connect seamlessly from anywhere in the world. In particular, Chinese suppliers who would typically exhibit at Techtextil can take part in Cinte Techtextil China with both a physical and online presence, to connect with buyers they would normally meet in Frankfurt.

Cinte Techtextil China's product categories cover 12 application areas, which comprehensively span the full range of potential uses of modern technical textiles and nonwovens. These categories also span the entire industry, from upstream technology and raw materials providers to finished fabrics, chemicals and other solutions. This full coverage of product groups and application areas ensures the fair is an effective business platform for the entire industry.

Design freedom with ColorMind

B.I.G. Yarns, based in Wielsbeke, Belgium, is introducing the ColorMind two-step polyamide 6 yarn collection which brings greater design freedom to manufacturers of high-end loop-pile contract and automotive carpets.

Available from mid-June 2021 in both standard and EqoCycle 75% recycled content yarns, designers are invited to work closely with B.I.G. Yarns experts to realise new designs.

The ColorMind colour bank features pre-defined colours which are always in stock.

Combinations of variable levels of twisting and air entanglement, using up to six colours at once, elevate design possibilities beyond current limitations.

The ColorMind colour bank features pre-defined colours which are always in stock for shorter lead times. Manufacturers can also benefit from customised lot sizes and bobbin lengths, creating even more flexibility.

As a taster of the potential directions opened up for loop-pile carpets, B.I.G. Yarns has used the technology to achieve its own Optica dot and Illusion wave effects.

'ColorMind offers never-before-seen yarn diversity to support a new level of design sophistication in high-end carpet segments,' said Emmanuel Colchen, general manager of B.I.G. Yarns. 'We're very proud and excited to enter into two-step yarns with a solution offering something truly special - the result of intensive dedication from our design and development teams. It combines our strengths in delivering high-performance and more sustainable yarns to fit the evolving demands of these segments, underpinned by our expertise in colour sequencing and mixing. We're looking forward to exciting collaborations and innovative, eye-catching designs for future loop-pile carpets.'

Compostable Coterie with Veocel fibres

New York-based baby care brand Coterie is launching wipes made from 100% plant-based biodegradable and compostable materials.

Designed in partnership with Lenzing Veocel, the Coterie wipes are the most sustainable and the largest (up to 30% bigger) baby wipes on the US market.

Wipes decompose in just a few weeks even under the toughest of conditions

Following recent certification testing, they have proved to be fully compostable after just a few weeks and decompose even under the toughest of conditions. By comparison, the acceptable standard for compostable products can take up to six months, and plastic-based products, like most competitive wipes, can take hundreds of years.

Additionally, the new wipes are the first in the USA to be certified by the Environmental Working Group (EWG) for chemical safety, the National Eczema Association for gentleness, and TÜV-OK Compost HOME for sustainability.

The new wipes effectively remove dirt and irritants while helping protect the skin's barrier properties and natural pH balance. The wipes contain 99% purified water with 1% carefully selected ingredients including Vitamin E and glycerin to protect the baby's skin further. They are also dermatologically tested for safety, even on sensitive or eczema-prone skin.

'We're on a mission to revitalize the baby-care space while setting new industry standards for performance and sustainability,' said Frank Yu, founder, and

CEO of Coterie. 'Our partnership with Veocel is a testament to our continued investment and dedication to sustainable innovation, and we're proud to have designed another high-performing product that provides the perfect combination of effective cleaning, enhanced skin health, and efficiency for the environment.'

'To address adverse environmental impact brought about by the diapering industry, transparency around raw materials used in wipes is one of the key measures to ensure that consumers make informed choices about product ingredient and disposal,' said Jürgen Eizinger, vice president of Lenzing AG's nonwovens business. 'We are dedicated to empowering the industry with materials that can build a more environmentally friendly future together.'

American Eagle launches Jeans Redesign collection

The Ellen MacArthur Foundation's Jeans Redesign scheme, a circular campaign aimed at transforming the market for the better, has added American Eagle to the growing list of denim brands involved.

The AE x Jeans Redesign collection launched, adhering to the initiative's requirements for recyclable, durable denim. The collection is made of 100% organic cotton and features easy-to-remove hardware. There are two mom jean fits for women and two slim jeans fits for men. The denim garments are finished using water-saving techniques and no harmful chemicals, as per the instructions.

The change follows American Eagle Outfitters (AEO) CEO and executive chairman Jay Schottenstein's positive forward-looking remark in April, in which he stated that denim's transition to broader fits has been good for business.

The adoption of the Jeans Redesign adds to American Eagle's ambitious sustainability goals, which it outlined in 2019. In only one year, it reduced water consumption in jeans by 21%, saved 2.4 billion gallons of water, used 37% sustainably sourced cotton, and featured almost 70 million recycled polyester bottles in recycled polyester.

With new partnerships, Schottenstein believes the brand's environmental commitments will only get stronger.

Schottenstein said by taking steps to ensure more responsible product procurement, they are trying to help future generations live in a healthier environment. They've committed to using more renewable raw materials and processing processes, as well as reducing their water and energy use, as part of AEO's wider sustainability targets.

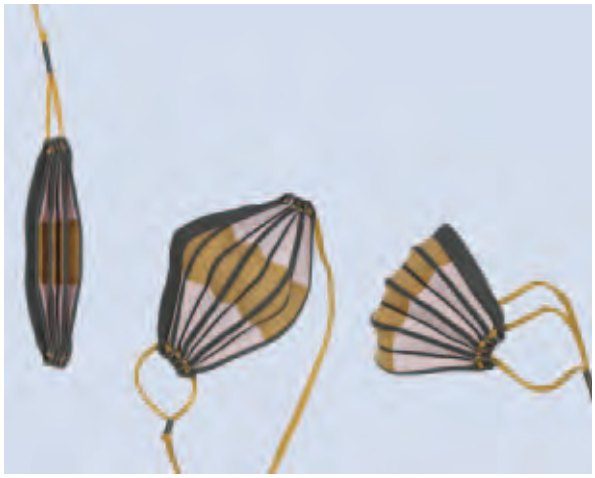
While it only began in 2019, the Jeans Redesign movement has already gained widespread traction in the fashion industry, with Tommy Hilfiger, Gap, and Frame all launching their first collections based on the circular guidelines. The Ellen MacArthur Foundation launched a mini-documentary outlining the relevance and success of its campaign to keep the momentum going.

EASY MASK - sustainable industry collaboration

As we enter the second year of the worldwide COVID-19 pandemic there is a continuing need for masks. While face masks help greatly in mitigating the spread of the virus and protecting the wearer, they also contribute to environmental problems such as waste and pollution.

EASY MASK is a collaborative initiative between Indorama Ventures, DyeCoo and STOLL to produce a fashionable mask with a sustainable mind-set throughout the whole production process - starting from the yarn production and followed by the dyeing, design and production. With the advanced technologies of the three companies, the mask does not just eliminate waste, but also reduces the use of water and energy. The design approach ensures that all components can be easily removed and re-used for other masks.

Deja™ is the sustainable recycled polyester brand from Indorama Ventures. The polyester performance yarn is made from 100% post-consumer recycled PET bottles and can be used for a multitude of home and apparel applications. The yarn is independently certified and traceable, with full transparency across raw



Screenworks implements Kornit Digital DTG technology

Kornit Digital, a worldwide market leader in digital textile printing technology, has announced that United Kingdom-based apparel decorator Screenworks has supplemented its traditional screen-printing operation with the Kornit Avalanche HD6 system for single-step digital direct-to-garment (DTG) production on demand.

While the business intends to continue using screen-print presses to fulfill high-volume orders, they found growing demand for on-demand production in smaller quantities, delivering complex graphics with little setup time and cost while eliminating inventory risk. By adding Kornit's efficient, sustainable technology for retail-quality impressions at low and consistent cost per print, Screenworks can produce only what has been sold, to achieve a streamlined, highly responsive production model.

Using a barcode-based system for routing artwork from point of sale to the print system, to the dryer for curing, to quality control, and on to shipping, Screenworks believes Kornit Avalanche HD6 is a critical component for achieving its goal of increasing automation and reducing waste from its cycle, ensuring customers receive their goods promptly and reliably.

'Opening up different sales channels for us, the Kornit Avalanche HD6 has brought us flexibility, adaptability, and profitability with a high-definition print,' said Alan Porter, Operations Director at Screenworks. 'The pretreatment was a key factor for us, as we can load a shirt, print it, take it off, and dry it without having a secondary process. Training people on this system is a lot easier and a lot more efficient than it would be to train more screen-print operators.'

material and processes including GRS, Ecomark, RCS, Oeko-Tex 100 and Reach.

Locally sourced 100% post-consumer rPET products offer a low-carbon footprint and closed loop solution. Deja™ is 100% recyclable at the end of use and can be repeatedly re-processed without harmful emissions or discharges to create new high value-added products.

EASY MASK is a fresh approach to reinterpret a traditional medical facemask from a design perspective. It is a 3D knitted and playful kinetic object that expands and collapses easily. It is simple to use and comfortable to wear; be it over the face or around the neck. The design approach allows customization, on-demand production, and reduces production waste to below 1%. Integrated ventilation increases breathability. Whilst it does not protect the wearer from infection it limits the spread of viruses.

The mask is knitted on a STOLL CMS 530 HP B E 7.2 machine, but can also be knitted on other types of STOLL machines. This allows for flexible local production independent of the machine park.

Arkema expands Bostik US adhesives business

Bostik, Arkema's Adhesive Solutions segment, has expanded its US offerings in high-performance adhesives with the planned acquisition of Edge Adhesives Texas, a complementary asset in hot-melt adhesives and pressure-sensitive adhesive tapes for residential construction. According to Arkema, this new adhesives line can be used for fiber-reinforced films and glass fiber mats, although they are not applicable to manufacture prepreg. This project is in line with Arkema's strategy of bolt-on acquisitions to develop greater breadth in adhesives and deliver new products to meet expanding demand.

Edge Adhesives Texas is a leading developer and manufacturer of innovative adhesive solutions used in residential buildings with reportedly annual sales of around $ 12 million. The company, which operates a plant in Fort Worth, Texas, has approximately 50 employees and specializes in custom formulations in fast-growing easy-install window, door and roofing applications.

Arkema itself is involved in delivering composite solutions to the construction market. The company notes its innovative platform, 'Home efficiency and isolation,' which focuses its R&D on materials and solutions for sustainable construction. Projects are also conducted to respond to the UN's sustainable development goal, in particular SDG 11 to 'make cities and human settlements inclusive, safe, resilient and sustainable.'

Arkema is also a strategic member of a partnership for a project involving the development of factory-manufactured modular construction using prefabricated composites and the company's thermoplastic liquid resin, Elium. Elium thermoplastic resin, a product of Arkema's research, was selected for its combination of technical performance with polymer recyclability. Reinforced with glass fibers, this resin has mechanical characteristics that comply with construction normative requirements; it is also weatherproof, resistant to UV radiation and fire resistant. In comparison to other resins used in composites, Arkema says it is 100% recyclable. Thus, at the end of their life, the composite elements can be recycled either mechanically or chemically.

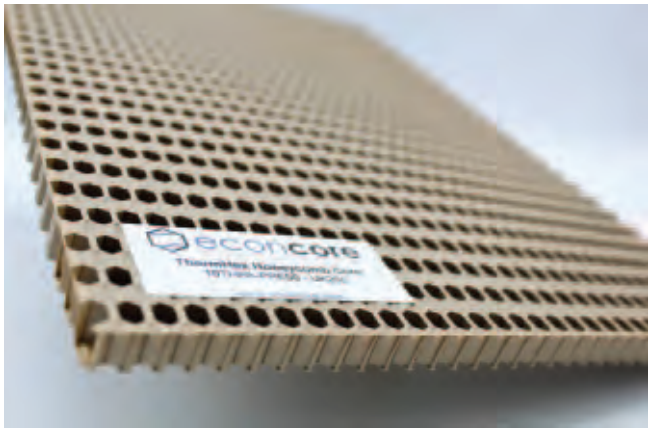
In addition to delivering strong technological, industrial and commercial synergies, its acquisition of Edge Adhesives Texas will enable Bostik to

offer its customers an extended range of value-added and sustainable solutions in hot-melt pressure sensitive adhesives.

EconCore's honeycomb cores deliver high heat performance

EconCore, a global leader in honeycomb technologies, has developed new honeycomb cores for laminated sandwich panels made with SABIC's NORYL GTX™ resin, a polyphenylene ether (PPE) blend, and EconCore's proprietary technology. The new honeycomb core presents higher heat performance, better dimensional stability and lower water absorption compared to honeycomb structures made with traditional thermoplastics. These properties enable the new core material to be used in demanding applications such as certain automotive, e-mobility and photovoltaic components. Furthermore, combining this new honeycomb core with thermoplastic composite skins to produce an all-thermoplastic sandwich panel can facilitate recycling. These desirable performance attributes and enhanced sustainability can open new market and application opportunities for EconCore honeycombs made with NORYL GTX resin.

Thermoplastic honeycomb structures deliver a high performance-to-weight ratio and efficient energy absorption under impact. The rigidity of honeycomb sandwich panels is known to exceed that of monolithic materials, including solid composites. Also, sandwich structures are an effective means of reducing mass in a wide range of weight-sensitive applications. Combined with an effective, in-line integrated sandwich panel production technology, this weight reduction has positive implications for overall production cost savings and environmental responsibility.



Dutch PPE Solutions starts meltblown production

Dutch PPE Solutions, the joint venture of Royal DSM and VDL Groep, has begun the sustainable production of virus filtering material for FFP2 and IIR facemasks in a newly built factory in Geleen, the Netherlands.

Dutch PPE Solutions is the first to deliver professional facemasks with the critical filter layer made entirely on Dutch soil with the company hoping that the joint venture will make Europe less dependent on supplies from overseas.

The high-quality meltblown polypropylene fabric is made from bio-based feedstock - used cooking oil - and the manufacturing line runs on renewable electricity. Dutch PPE Solutions' ambition is to produce the most sustainable filter material for FFP2 and IIR facemasks.

DSM and VDL joined forces in September 2020 to meet the urgent need to diversify the global production and supply chains of personal protective equipment at scale by reducing dependency on a small number of international sources.

The companies invested several million Euros in manufacturing equipment to produce facemasks and in the new manufacturing facility for meltblown polypropylene. The joint venture employs dozens of people in its production locations in Geleen and Helmond, the Netherlands.

Dutch IIR facemask manufacturer MedProtex is Dutch PPE Solutions' first customer of meltblown polypropylene. Cyrille Depondt, CEO MedProtex said, 'To establish a sustainable, transparent and futureproof production chain of personal protection equipment, it is crucial to have access to raw materials close to home. The opening of the factory for high-quality critical filter material in Geleen is a testimony to entrepreneurship and a proofpoint for making our Dutch and European infrastructure more resilient for future pandemics. At MedProtex we believe in short, sustainable chains and transparency. Dutch PPE Solutions delivers just that. That's why we decided to use their meltblown polypropylene filter material in our products. This powerful collaboration is Made in Holland and creates multiple value on economic, social and ecological level.' ATJ

Home textiles to grow on sustained demand

India Ratings said that home textiles exporters are expected to witness growth in their topline and bottomline on account of sustained demand and stable raw material prices. The home textile segment continued to exhibit demand resilience, led by the healthy demand, it added. In home textiles, 'a sustained demand and stable raw material prices will lead to growth in exporters' topline and bottomline,' Ind-Ra said in a report.

While home textile players reported a healthy rise in topline during FY'21, operating margins were impacted during the fourth quarter of FY'21, on account of an import duty on cotton along with uncertainty over remission of duties and taxes on export products incentives, the report stated.

Meanwhile, cotton prices corrected during April 2021, led by lower demand from mills operating under lower capacities on account of micro lockdowns domestically.

Also, the report revealed that while the United States Department of Agriculture Foreign Agricultural Service (USDA-FAS) expects the domestic crop to increase by 2 per cent year-on-year in the next season commencing October 2021, consumption is slated to increase by 6-8 per cent year-on-year, leading to a reduction in ending stocks.

The marginal rise in production is despite an expected lower area under cultivation for the next season, albeit supported by a normal monsoon and increasing yield by 5 per cent to 497 kg per hectare, added the report.

The home textiles segment continued to exhibit demand resilience, led by the healthy demand,

Grasim to further expand capacities

Grasim Industries, an Aditya Birla Group company, plans to invest Rs 2,604 crore (excluding paints and fertiliser) in this fiscal, against Rs 1,508 crore spent last fiscal. Line-1 of the Viscose Staple Fibre (VSF) expansion project at Vilayat, Gujarat, is scheduled to be commissioned in Q2FY22, and Line-2 in Q3FY22.

Other capex are towards increasing capacity at the Advanced Materials (Epoxy) business by 125,000 tpa, through a brown field expansion at the existing location of Vilayat.

Meanwhile, Grasim has reported a 13% increase in March quarter consolidated net profit at Rs 2,617-crore, against Rs 2,309 crore logged in the same period last year, largely due to better realisation. Revenue was up 26% at Rs 24,399 crore (Rs 19,350-crore) while Ebitda was up 56% at Rs 5,142 crore. The company declared a dividend of Rs 9 per equity share.

Revenue from the discontinued fertilizer business was down at Rs 561-crore (Rs 623 crore) while Ebitda almost halved to Rs 33 crore (Rs 68-crore). The financial performance of the fertilizer business was not included in this quarter as the company expects to divest the business by Q2 of FY22.

The revenue from the viscose business was up 23% at Rs 2,583 crore (Rs 2,102 crore,) while Ebitda more than doubled to Rs 625 crore (Rs 261 crore) due to higher sales volumes and better realisation.

Revenue from chemical business was up at Rs 1,472 crore (Rs 1,290 crore) and Ebitda stood at Rs 185 crore (Rs 104 crore).

Trident to raise up to Rs 1,100 crore

Textiles and paper maker, Trident Ltd, is planning to raise up to Rs 1,100 crore from the market by issuing NCDs and equity shares in tranches. The company's board approved raising up to Rs 600 crore by issuing Non-Convertible Debentures (NCDs) and up to Rs 500 crore through equity shares, Trident said in a regulatory filing.

The board also recommended the fund raising resolution to be approved by the shareholders in the next meeting, it added. Besides, it approved the appointment of Naveet Jindal as CEO for

Paper, Chemicals and Energy Business of the company and Swapan Nath as CEO for Budhni Location. Both the appointments are effective from May 15, 2021.

Trident also informed BSE that its board has approved 'change in designation of Rajiv Dewan to act as Chairman of the board of the company with an immediate effect.'

Its board also approved the resignation of Pallavi Shroff as director of the company with immediate effect and the appointment of Usha Sangwan as additional director.

On raising of funds, Trident said the board had cleared the resolution for raising of funds 'for an amount not exceeding Rs 600 crore by issue of NCDs by way of public or private offering, in one or more tranches.'

It also approved the resolution for raising of funds 'for an amount not exceeding Rs 500 crore by issue of equity shares, non-convertible debt instruments' along with warrants, convertible debt instruments or by way of a public or private offering, including QIP.'

Welspun India to work again with Target Corporation

Welspun India said it will work with US retail giant Target Corporation again, almost five years after Target terminated its contract with the Gujarat-based textiles maker over alleged lapses in labelling and marketing of Egyptian cotton products.

'The company and Target Corporation, a retailer with over 1,900 stores in the USA, will be working together again, having recently completed a vendor re-empanelment process with Welspun Global Brands Ltd., company's subsidiary,' Welspun India said in a regulatory filing.

Welspun India said until 2015-16, the business with Target Corporation accounted for almost 10 per cent of its overall business. 'The company shall strive to foster a strong, transparent and sustainable business relationship with Target Corporation going forward,' the company said.

Target Corporation, a retailer with over 1,900 stores in the USA, will be working with Welspun Global Brands Ltd again

In 2016, Target Corporation had terminated its contract with Gujarat-based Welspun over alleged lapses in its products supply.

ElgiEquipments fourth quarter results

ElgiEquipments Ltd, manufacturer of Air Compressors, announced the results for the fourth quarter and financial year ended 31st March 2021. Consolidated PAT for the quarter was Rs 43.36 crore compared to Rs 1.05 crore in the same period in 2019-2020. Consolidated PAT for the financial year was Rs 102.49 crore compared to Rs 42.57 crore in 2019-20.

Consolidated sales for the fourth quarter was Rs 610 crore as against Rs 455 crore in the corresponding quarter in 2019-2020. Consolidated sales for the financial year 2020-21 was Rs 1924 crore as against Rs 1829 crore in 2019-20.

The standalone PAT for the fourth quarter was Rs 48.85 crore compared to Rs 42.01 crore in the same period in 2019-20. The standalone PAT for the year was Rs 105.09 crore compared to Rs 100.42 crore in 2019-20

The Board has recommended a dividend of Re.0.80 per share (80%) for the year 2020-21, subject to approval of the shareholders.

The compressor business performance in the domestic market was commendable in the fourth quarter while performance on an annualized basis saw marginal growth over last year. The business has performed well in all of the global markets it is present in.

In a very challenging environment, sales of the automotive business witnessed improvement over the same period of last year.

Cotton price drops on lower demand

Cotton futures traded lower at Rs 22,110 per bale on May 14. The Agri commodity traded in the red after a gap-down start despite the firm global trend and stronger rupee. India's cotton output in the 2020-21 (October-September) market year is seen at 38 million bales, up 4 percent on the year.

The country's cotton exports are likely to be 20 percent higher at 1.02 million tonnes in 2020-21 (October-September) backed by competitive pricing in the global markets and an improvement in international cotton consumption, said Care Rating. Higher exports along with a recovery in domestic cotton demand will help reduce the surplus availability of cotton in the nation despite higher supply, the rating agency said in a note.

Mr Sunand Subramaniam, Senior Research Associate, Choice Broking said, 'We expect MCX Cotton futures to trade bearish as cotton farmers from various states are planning to increase the area

Techtextil India: First hybrid edition moves to November 2021

India's leading trade fair in technical textiles, nonwovens and composites, originally scheduled in September 2021, has now been postponed to 25 - 27 November 2021. On account of the developments around the current Covid-19 situation and its relative impact on the safety, well-being and continuance of business, Messe Frankfurt India has taken this decision in consultation with industry stakeholders.

Even as companies look forward to economic revival, the continued difficulties posed by the pandemic makes it necessary for industries to recover, plan and prepare before they can get down to business. The organisers feel

that moving the show ahead will allow this additional time and is a necessary step that will in-turn create a healthy business environment when the industry can finally come together.

Mr Raj Manek, Executive Director and Board Member, Messe Frankfurt Asia Holdings Ltd said: 'We are glad to have the support from the industry and our exhibitors whose interests are at the centre of this decision. Exhibitors, just like organisers, are working around undefined parameters which require adequate planning flexibility. We are all committed to putting up a great show!' Elaborating on working together with venue and service providers to align safety measures, he further added, 'Right now, our focus is on the well-being of our exhibitors, visitors, employees and all stakeholders and we pray for everyone to be safe and in good health. In the coming months, our efforts will be strongly focused on meeting the safety imperatives and working in co-operation with venue authorities and service providers to implement a comprehensive safety concept, aligned with government guidelines.'

Proving its growing importance in these critical times, technical textiles emerged as a power sector with advanced solutions in protective textiles, antiviral and air-purifying furnishing fabrics and home textile products, anti-microbial coating among others.

During the critical stages of lockdown when global trade came to a grinding halt, the medical textile industry proved its resilience in meeting demand for protective textiles while also providing a much-needed boost to the economy. From being a primary importer of PPE kits to becoming its 'second largest producer' in just two months, India had exported over 20 million PPE kits and more than 40 million N-95 respirators around the globe including countries such as the US, the UK, the UAE, Slovenia and Senegal, by the end of 2020. Even in these challenging times, the industry remains future-focused and prepared to meet vital demand for med-tech, agri-tech, geo-tech, sports-tech, and infra-tech, home tech among others.

A key exhibition in the business calendar, Techtextil India will continue its critical role in highlighting solutions and innovations that are need of the hour across twelve key application areas. With a comprehensive safety concept under the 'MFISafeConnect' standards, Techtextil India will open its doors from 25 - 27 November 2021 at the Bombay Exhibition Centre Mumbai. This will be the first-ever hybrid edition as the trade fair will be held as a physical expo in conjunction with its online event on the same dates.

under cultivation in the coming 2021-22 Kharif season. Indian textile mills have reduced production due to lower domestic demand and labour shortage.'

'The government has allowed mills to operate but markets are closed so mills are facing a cash crunch. Textiles mills dealing in exports are still going strong as Indian yarn prices are attractive. Cotton arrivals are very low due to COVID cases and lockdown in many parts of the country,' Mr Subramaniam added.

Cosmo announces the launch of environment friendly Microenz BS

Cosmo Speciality Chemicals Pvt Ltd, a wholly Indian subsidiary of Cosmo Films Ltd, announces the development of Microenz BS sourced through enzymatic process, making it an environment-friendly alkaline pectatelyase. Thus, it helps eliminating the challenges posed by the chemical when sourced through traditional processes such as high ETP load, usage of very harsh chemicals, wastage of water and time etc.

Embarked on the key product innovation principles of multi-functionality (performance oriented), process optimisation (energy, water and time saving) and sustainability (eco-friendliness), the advancement of Microenz BS ensures less fabric and garment damage as Pectatelyase degrades the pectin from the primary cell wall of cotton without degrading the cotton itself, improved functional finish, lower yarn coefficient of friction, increased yarn elongation for improved weaving efficiencies, improved emerising and brushing properties, no degradation of cellulose and lower weight loss while being safe and easy to use as well as eco-friendly.

The chemical Microenz BS works in a way which is specially designed for the end-users using alkaline pectatelyase as pectatelyase degrades the pectin from the primary cell wall of cotton without degrading the cotton itself. Microenz BS can also be used successfully for combined desizing and bio-sourcing (CDB). The dosage used for application is exhaust with doses 1.0% to 1.2%.

On this new innovation by the

company, Mr Anil Gaikwad, business head, Cosmo Speciality Chemicals said, 'For medium and darker shades on cotton yarn & knitwear, we suggest a one-bath-two-step pretreatment process. We propose an enzymatic pectinase treatment with Microenz BS 1.0 to 1.2% in combination with a mild peroxide bleach. This process includes a pectinase treatment as well as a mild peroxide bleach. The mild conditions lead to a softer handle in comparison to alkali-treated goods. Furthermore, bio-scoured cotton shows relatively good hydrophilic properties.'

Apparel exporters from Noida face labour shortage

Apparel exporters from Noida, Delhi's south-eastern neighbourhood, are facing an acute labour shortage with more than half a million mill-hands and artisans returning to their homes in rural Uttar Pradesh to escape the urban covid surge.

Given the labour shortage and its likely impact on output, buyers from the US and Europe are shifting a portion of their orders from India to alternative sources in the neighbourhood - Bangladesh and Vietnam.

'The units are currently operating at 40% capacity as there is an acute shortage of workers. Out of 10 lakh workers in the exports cluster, only 4 lakh workers are now engaged in daily operations,' said Mr Lalit Thukral, president, Noida Apparel Exporter Cluster. "The rest have left for their hometowns.'

The Noida textile exports cluster houses 3,000 units, and the major importers are labels such as Zara and Mango, Mr Thukral said. 'The textile units in Tamil Nadu and Karnataka are closed due to the lockdown. Only garment export units in Uttar Pradesh and Haryana have remained open. So, this could have been a major opportunity for us, if the labour supply situation was normal,' he added.

The cluster exports apparels worth Rs 25,000 crore. Last year, due to the pandemic induced lockdown across the globe, exports had shrunk to Rs 20,000 crore. 'If the labour situation does not improve and vaccination does not pick up, then exports from Noida may come down by 35% this fiscal year,' he said.

'We will lose out to countries like Bangladesh and Vietnam. Already, we are witnessing a portion of the order from the international market shifting to these countries,' he added.

At the same time, input costs have risen. The steep rise in the prices of yarn and cotton could dent margins. 'Yarn prices increased more than 20 percent in the second half of the last fiscal. Exporters enter into a price agreement with buyers at least six months before supply. Now, while the mills are increasing the prices frequently and arbitrarily, the buyers or importers are not willing to increase the prices,' added Mr Thukral.

Indorama increases capacity in India

Indo Rama Synthetics, a subsidiary of global petrochemical producer Indorama Ventures (IVL) is to invest up to US$82 million upgrading equipment and adding capacity at its manufacturing site in Nagpur, India.

The capital expenditure plan includes a new PET resin manufacturing facility, additional balancing equipment and lines to produce a large range of specialty yarns, further strengthening the company's ability to serve clients across the country.

India is a strategic market for IVL, where the company operates all three of its global integrated business segments - Combined PET, Fibres and Integrated Oxides and Derivatives (IOD).

IVL has continually developed its PET resin business in India since 2016 through IVL Dhunseri Petrochem Industries, a joint venture with Dhunseri Ventures.

The new PET resin facility at Nagpur will add 700 tons of capacity per day and is expected to be operational by the second quarter of 2022. Together with plants at Haldia and Karnal, the Nagpur facility further strengthens IVL's position as India's largest resin producer, with a total capacity of over a million tons annually.

The plant at Nagpur, which IVL has managed since 2019, is also the company's first fibre manufacturing site in India, offering a wide range of staple fibers and filament yarns. Under the investment plan, it will meet increasing demand from global brands for more high-quality and sustainable textile products.

'India is a strategic high-growth market for us,' said Mr D K Agarwal, CEO of the Combined PET, Fibres and IOD business at Indorama Ventures. 'Our capital expenditure plan reflects our long-term commitment to the industry's development in India. It is important that we continually invest to ensure that we can serve our customers across India, wherever we are needed.'

Pandemic poses challenges for textile industry

The sudden spike in Covid-19 infections in India, especially in and

The new PET resin facility at Nagpur will add 700 tons of PET resin capacity per day.

Upscaling of durable and user-friendly handicrafts to deepen sectoral reach

Prime Minister Narendra Modi said the upscaling of durable, user friendly handicraft products will help the sector expand and deepen its outreach.

While inaugurating the 51st edition of virtual IHGF of Delhi fair, he appreciated the richness and diversity of India's handicrafts, textiles ministry said in a statement. The virtual fair is being held from May 19-23.

'Generations of artisans and craftsmen from different regions have enhanced the appeal, adding colour and vibrancy to the products,' the ministry said, quoting Prime Minister Modi.

As per the statement, the Prime Minister said that the fast changing times, powered by digital technology have helped the handicrafts sector to further enhance its resilience.

'This edition of the virtual fair will help in giving a much needed push to the exports of handicrafts and generating additional employment in this cottage sector of Indian economy,' the ministry said, quoting textile secretary, Mr U P Singh.

Organised by the Export Promotion Council for Handicrafts (EPCH), it is India's largest virtual fair in the home, fashion, lifestyle, textiles and furniture sector and an exclusive B2B online platform is developed to assist the buyers from all across the globe to source from India.

EPCH director general, Mr Rakesh Kumar, said that craft demonstrations by artisans on blue pottery, Warli painting, screw pine craft, Kani shawls, Meenakari, artistic textiles will also form part of the activities that are scheduled during the fair.

As per the statement, the fair will see participation of 1,500 plus manufacturers and exporters showcasing 2,000 plus product expressions. The overseas buyers from over 85 countries from across the globe have already registered to visit the show.

around the textile hubs, has hurt the textile sector, albeit temporarily, at a time when the industry has been gearing up to meet strong export demand catalysed by geopolitical factors.

Though exporters were expecting some impact from the second wave, they were confident of overcoming it due to learnings from the first wave, and adequate precautionary measures were put in place.

The second wave has, however, posed a lot of challenges for manufacturers in the textile hubs of Tiruppur and Coimbatore.

While Coimbatore is the second worst-hit region after Chennai, Tiruppur has also seen a spike in daily new cases over the past few days.

'Tiruppur has seen a complete shutdown of textile units, while export-oriented units in the outskirts and rural areas are trying to operate with skeletal staff,' said Mr Prabhu Damodharan, Convenor, Indian Texpreneurs Federation.

Each unit is adopting calibrated measures and adhering to government guidelines. Industry representatives say that units have realised the need to break the transmission of virus and are ready to undergo the short-term pain for long-term gains once key export markets see a revival.

Mr A Sakthivel, chairman, Apparel Export Promotion Council (AEPC), points out that while new infections in Tiruppur have increased, it is not at alarming levels despite being an industrial township with about five lakh workers. But exporters have taken adequate precautions to execute some important orders.

Mr Damodharan also pointed out that key consumption markets are witnessing a demand boom and the industry has communicated to the buyers that the lockdown and restrictions will be a short term one, may be for three weeks.

'We told them that we will meet their requirements as we have adequate raw material and manpower to ramp up quickly. In some product cases, we have order visibility for six months,' he added.

Mr Damodaran said organised players have retained their migrant labourers and workers by providing them with accommodation and making arrangements to vaccinate them at the earliest.

'I would say about 95 per cent of migrant workers are staying back. The association has also communicated to the members that this would be a short-term disruption and workers can be retained with adequate protective measures,' said Mr Sakthivel. ATJ

Safe and sound
Data security in smart factories

Digitalization has a very good chance of becoming one of the words of the year. Digital solutions are enjoying a boom - particularly in the age of mobile working, travel restrictions and limited personal contact. Here, we all transmit a considerable amount of data through the web that we need to know is absolutely secure. When it comes to digitalization, Oerlikon Manmade Fibers Solutions pays particular attention to one thing - data security in smart factories.

Sebastian Helmer, Teamlead Infrastructure Services and Information Security Officer Business Processes & IT at Oerlikon Manmade Fibers Solutions

The IT experts within the Oerlikon Manmade Fibers Solutions business unit are also busy ensuring the data of its customers are secure. Digital solutions such as Remote Service, AIM4DTY, Smart Maintenance Workshops, Plant Operation Center and the fully networked 'smart' factory necessitate a secure infrastructure.

How this can be achieved is explained by Sebastian Helmer, responsible for Information Security at Oerlikon Manmade Fibers Solutions: 'Secure by Design' is currently standard practice for establishing the necessary IT security in the product from the outset. With our textile market expertise, intensive interaction with customers and our company-internal international experience, we have developed a picture of our customers' requirements, which we are constantly expanding. We also deploy common standards in the development of solutions - including ISO27001 and IEC62443, among others. Build-ing on this, we develop our own smart factory security solutions, all the way through to customized solutions. We test new solutions by means of so-called pen tests - here, tests are carried out to hack the system in order to close potential security gaps in a targeted manner - in order to further improve them and check our environments with security architecture reviews.'

The smart factory

Ceasing to be a mere vision long ago: the smart factory. Of critical importance here is the close relationship between IT and innovation. 'With the smart factory concept, we have developed from an operator into a consultant. On the one hand, IT enables innovation. At the same time, innovation is, however, also taking place in IT - culminating in new-generation digital products. Hence, both cross-fertilize each other', explains Chief Technology Officer at Oerlikon Manmade Fibers Solutions, Jochen Adler, talking about the interaction between the two disciplines.

Jochen Adler, CTO Oerlikon Manmade Fibers Solutions

Operating a yarn manufacturing system requires various components and solutions: everything is present - from the control level, the Human Machine Interface (HMI), the automation systems, the Plant Operation Center all the way through to cloud solutions. All this requires smart infrastructure, which - in addition to a reliable network - includes a high-performance edge computing solution that, coupled with a modern software platform (CSP) and a correspondingly high security level, safeguards the security and the quality of the end-product. By nature, data security is also decisive for all downstream processes within the textile value chain that build on the collated data or for merchandise management systems that are directly connected to the smart factory.

Secure data exchange

Services such as Remote Support and tools including the AIM4DTY training center necessitate data exchange. 'Here, we draw on high standards for the purpose of encryption, customer separation and also minimizing data', states Sebastian Helmer. 'We basically distinguish between three categories of threat scenario: firstly, we have the unconscious actions of employees who unintentionally load malware onto a system without realizing this themselves. Then there are the attacks that have no concrete objective; here, perpetrators attempt to attack a company by means of SPAM or phishing. And, finally, there are attacks that focus concretely on a specific company. Here, perpetrators try to plant malware using targeted methods. This can extend all the way through to social engineering in order to exert influence over the relevant persons.'

The Oerlikon Manmade Fibers Solutions business unit is superbly equipped for the task with its smart factory solutions: 'We have been supplying our customers with secure, certified hardware for decades now. And we also apply these standards to our software solutions: our digital products work with a safety net and a false bottom - hence ensuring secure and reliable operation at the customer site', promises Jochen Adler. ATJ

Modern developments in industrial textiles

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As the name indicates Indutech means textiles used for industrial purposes like filtration, conveying, cleaning etc. It is one of the technical textiles which contains solution and products for varieties of industries for examples 3D textile and conductive textiles. These industrial fabrics or products are in woven, nonwoven, and knitting. Industrial textiles are almost used in all the major engineering fields and products like paper, metal, carbon, plastics, ceramics, glass fibers etc. across the world[1]. The modern developments in technical textiles and industrial textiles are growing rapidly. Nowadays textile is spreading its reach in all engineering sectors. Today textile technology and technical textile has moved so far which is beyond our imagination. We would never have imagined that things like filters, convery, etc. can be made from textile material. It is the successes and achievements of technical textiles that we are seeing textile products in every engineering field and the speed with which textile technology is developing, it would not be wrong to say that in the coming time, textile should become the biggest job providing sector. This is a good opportunity for the government to invest money in textile as well as employment. The main purpose of this review is to give brief details of industrial textiles.

What is industrial textiles?

It is one of the branches of technical textiles which deals with high performance or high-tech textiles. As the name indicates that, the textile used for industrial purpose is known as industrial textiles.

Modern developments in industrial textiles

Conveyor belt

It is a type of moving belt which transfers materials from one place to another in a continuous motion and it is endless belt. It is a system which is environment friendly and fastest. When there is a bulk of transportation than this system is economic. It consists of following components such as carcass, insulation and cover. It moves unit load bulk as well as individually load continuously[2]. There are two or more pulleys for rotating the conveyor belt with a continuous loop. According to its application conveyor belt consists of different layers of different materials. The under layer of material which give linear shape and strength called cover. Leather and rubber are most common material used for cover. Cotton, PET and nylon are most common material used for carcass. To ensure high coefficient of abrasion resistance and friction, leather cover is always preferred. Due to this quality conveyer belt, a natural superior substitutes of conventional belts, give much more freedom in drive, design etc[3]. Rubber is used in conveyer belt to protect the carcass from material being conveyed and from any external condition which damage the belt's life. Thermoplastic is used in conveyer belts because it has non-

This paper highlights the modern developments in technical textiles and industrial textiles.

absorbent properties. They are highly repellent to chemicals and water. Due to presence of plastic it has high density and strength properties. Due to these properties it can perform in the wide range between 60°C - 100°C and this range depending upon thermoplastic used. Metals are used in conveyer belt for protection at high temperature. Metal type of belt have very low thermal expansion and high melting point coefficients[4].

Fabric is used in conveyer belt for following purpose :

- Improve mechanical fastener retention
- Reduces sliding drag on product
- Provides strength for tensioning
- Adds rigidity or stiffness
- Provide strength for handling the load.

Manufacturers

- Dura- belts, Inc. Hilliard, OH
- V - belt global supply, LLC Sioux Fall, SD
- Sparks Belting Company, Grand Rapids, MI
- VOSS Belting and specialty company, Lincolnwood. IT
- Chemprene Inc. Beacon, NY

Raw Material Used

- Leather
- Rubber
- Thermoplastic
- Metal
- Fabric.

Silk screen printing

It is a printing technique in which ink is transferred on substrate through mesh. The ink is passing through small hole of mesh on required area of design and by stencil material unrequired area will block. To fill the open mesh apertures a squeegee or blade is moved across the screen. For the manufacturing of silk screen printing the major raw materials required are polyester for meshing purpose, silk and synthetic threads. Polyester is used for mesh in silk screen printing because it has minimum thickness of fabric, tensile strength is excellent. The flow of ink is smooth because the stretching performance is excellent. The dimensional stability of PET mesh fabrics highly tensioned and dimensional stability screen of screen printing can be stretched and minimum off-contact distance printed[5].

Propulsion technology

To drive any object forward by action of pulling or pushing, this technique is used. This system consists mechanical power source. For any engine or motor, it is used as power source. For animals, it is used as power source in term of biological propulsion systems which is use in animal's muscles and limbs such as fine, wings or legs[6].

This technique is used in many things such as

- Ground
- Marine
- Cable
- Maglev
- Space
- Air propulsion.

Maglev

This system is for transportation in which magnetic levitation for propel, suspend and guide of vehicles with magnet. The vehicles move very quietly and smoothly and require less maintenance as compared to wheeled mass transit system.

Air propulsion

In aircraft, it has only aircraft engine so for generation thrust propulsive nozzle or propeller are used. For generate thrust propulsion system is used for balance wing, of airplane which airplane is cruising. To accelerate airplane wings must exceed by thrust from the propulsion system.

Wipes are used for removing liquid or dirt from surface by light friction or rubbing.

Filtration

In our day to day life filtration plays a very important role by contributing cleaner and healthier products as well as environment. For various filtration textile material is used such as air filtration, liquid filtration as well as in industrial production and food practices. In many purpose fabrics of filtration is used, which are power station, sewage disposal petrochemical and vacuum cleaners etc. due to the complicated structure and thickness, nonwoven and woven textile materials are best for filtration. To separate solid from liquids by a medium through which only liquid can pass, that medium is known as interposing medium. For this type of operation filtration act as mechanical or physical operation[7].

For the making of filter synthetic fibers are used because :

- High filtration rate
- Dimensional stability is good
- Temperature resistance is high
- It reduces fabric weight
- It has high strength
- Handling and replacing are very easy

Some advantages of nonwoven filter over the woven filter are as follows :

- Gasketing characteristics is good
- Blinding tendency is less
- Efficiency of filtration is high
- Permeability is also high
- Good cake discharge.

Air filter

Basically, air filter is made from pleated paper or spun fiberglass material. It cleans the air from our heating and cooling system.

Water filter

It is used for reducing or removing concentration of particulate matter such as bacteria, viruses, algae and fungi as well as chemical which is undesirable.

Wipes

Cleaning wipes in nonwoven

Wipes are used for removing liquid or dirt from surface by light friction or rubbing. They can be a tissue, nonwoven or paper. It is easier and quicker than other paper or cleaning material. That is major benefit of wipes. They are also used for many purposes such as dusting and floor cleaning, makeup application and removal and for baby care[8].

Classification of wipes based on their application :

- Household and home cleaning wipes

Table 1 : Industrial products and their uses[10]

Products	About Products
Nonwoven wipers	Cleaning wipers for industrial applications in knit and nonwoven form.
Woven filters	All woven filters for industrial applications
Conveyer belting	Woven fabric for conveying and specialty applications
Hoses	Braids, woven and knitted fabrics
Abrasives	Polishing and abrasion applications
Brushes	Bristles for brushes of all types
Drive belting	Machine drives and power transmission
Woven and knit wipers	Cleaning wipers for industrial applications in knit and woven form
Nonwoven air filter	Non-HVAC air filters for industrial applications
Paper marking felts	Dying fabrics and felts in paper marking
Cigarette filters	Tow for cigarette filters
Nonwoven dust filters	Filter used for dust bag house.
Nonwoven liquid filters	Filters media for food, vessel bag etc.
Other nonwoven filters	All other nonwoven filters
Battery separator	A) Fabric for floppy disc liners, transformers etc. B) Fabric for battery separators.
Ropes	Ropes and cords for use in industry
Lifting webs	Webs used for round sling lifting purpose
Seals gaskets	Material used for industrial seals and gaskets
Cable components	Central strength area for press forming and dying fabrics
Fiberfill	Fiberfill and wadding for miscellaneous industrial applications
Electrical composites	A) PCBs B) GRP composites for electrical applications including other producer durable equipment
Anti-corrosion composites	Anti-corrosions for storage tanks, pipes etc.
Miscellaneous coated fabrics	A) Coated fabrics for storage silos B) Coated fabrics for oil booms C) Heavy coated for miscellaneous applications.

- Industrial cleaning wipes
- Personal care wipes.

Industrial cleaning wipe

It is also known as cleaning wipes which is used in various industrial setting. These wipes are used for removing residues which are toughest in nature such as stain, dust oil, lubrication and grime. These wipes are used for removing above residues to keep machinery equipment clean to enable work efficiency and manufacturing during their product lifecycle[9].

Nonwoven technologies used in industrial wipes : wet laid, spun laid, dry laid, melt blown, air laid.

Advantages of nonwovens in industrial wipes :

- No significant residues of heavy metals
- High performance consistent custom engineering for each application
- Convenient, hygienic, excellent cost and value in use

Some Industrial products and their uses are given in *Table 1*.

Global market of industrial textiles

The demand of industrial textiles like decatising cloth, bolting cloth, coated abrasives, conveyor belts, computer printer ribbon, and industrial brushes etc. are the main reason for boosting the demand of industrial textiles or we can say that these are the factors which are driving the global market of industrial textiles.

As of 2017, the global industrial textile market was worth 115.5 billion USD and it is estimated that in the coming years it will become 153.60 billion USD by 2023.

The demand of industrial textiles is increasing day by day because of its widespread usage in different sectors like, conveyor belts, automotive carpet, protective apparel, transmission belts, and flame resistive apparel. The global market of industrial textiles is valued at 115.15 billion USD in 2017 and it is expected to reach 153.4 billion USD by the end of 2023, increasing at the rate of 4.9% CAGR during 2017 - 2023.

Technology and innovation play an important role for the development of any field, industrial textile is growing very fast today just because of

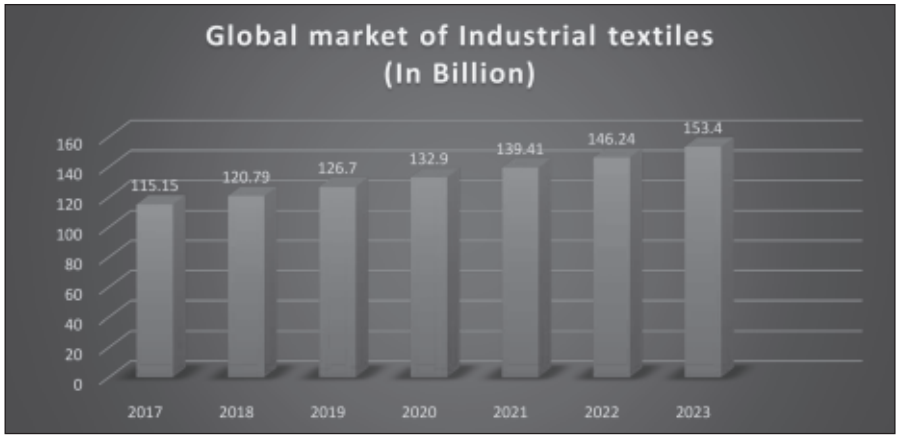

Fig 1 : Global market of industrial textiles[11]

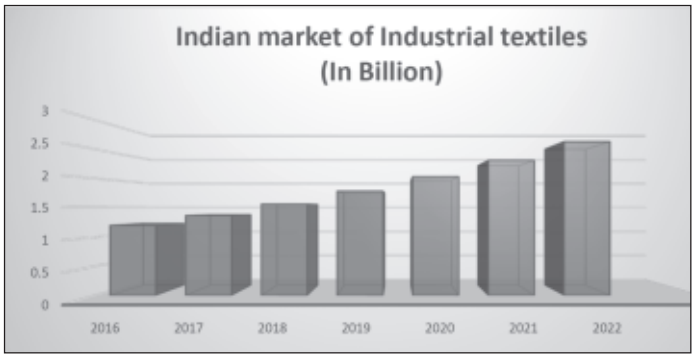

Fig 2 : Indian market of industrial textiles

Table 2 : Leading manufacturers of industrial textiles globally[13]

Manufacturer	Country
Dupont	USA
Ahlstrom-Munksjo	Helsinki, Finland
3M	USA
SKAP	Spain
Kimberly-Clark	North America
TORAY	Japan
Asahi Kasei	Japan
Hyosung corporation	South Korean
Shandong weiqiao pioneering	China
Ruyi	China
Sunshine	China

emerging technology and innovation. The global market of industrial textile is increasing by 8 billion USD approximately every year, which indicates the increasing demand of industrial textile globally.

Indian market of industrial textiles

As of 2016, the Indian industrial textile market was worth 1.2 billion USD and it is reached to 2.40 billion USD in 2020, increasing at the rate of 14% CAGR during 2016 - 2020. Indian market of Indutech is growing rapidly, today India is the fastest growing county among, USA, china, Japan, Brazil, Russia. USA and China are the global leader in manufacturing Indutech products but India is no more behind than these countries. Today India is exporting 1000 million USD with 14% CAGR every year and it's a great opportunity to India to become largest exporting country in the upcoming years[12].

Major vendors in the global market for Industrial textiles is given in *Table 2*.

Conclusion

In this study it is concluded that the demand of industrial textile is increasing very fast, which is creating many jobs in industrial textiles field especially in India. Today India is exporting 1000 million USD and it is increasing every year at the rate of 14%. So, it is a great chance for India to become global leader of industrial textiles. It is also a golden opportunity to entrepreneurs to invest which will change the global economic condition. By seeing India's growth rate, it is not far behind to become the largest exporter of industrial products in globe in upcoming 5-10 years. This was an investigating study of industrial textiles and its market size.

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Microfibers
Potential in technical textiles

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Increasing demands of fiber properties to develop sophisticated applications have led to rapid growth of microfiber technology with advanced means of production process. Microfibers are about half the diameter of silk, one third the diameter of cotton and one quarter the diameter of wool. The definition of ultra-fine fiber may vary according to the employed conventions. Textile Committee Germany, defines a micro-denier fiber as a 'fiber finer than 1.2 dtex for polyester and finer than 1.0 dtex for polyamide.'

The most of multicomponent fibers are composed of bicomponent fibers, whereas the bicomponent fibers are commonly classified into two groups as conjugated fibers and polymer-blended fibers. The differentiating factor among these two fibers is nothing but the variation in their continuity. Conjugated fibers are continuous along fiber axis, while polymer-blended fibers never have continuity in their structure. Acrylic orlon sayelle invented in 1963 was the first commercialized bicomponent synthetic fiber. Then-after various kinds of multi-component fibers were invented according to end-uses. Later invented fibers were functionally able of thermal-bonding, light conductive, self-crimping and with excellent absorbency. After the invention of bicomponent fibers, later fibers with various kinds of cross section have been developed. But, more often, multilayer structures have been developed specifically for splittable fibers to produce microfibers and their products.

In last 50 years, five major innovations in microfiber technology have been developed : artificial suede (1970), fabrics resembling silk (1972), super high density fabrics (1981), 2nd generation leather (1981) and high performance wiping cloth (1985). These artificial seudes are responsible for establishment of important technologies for microfiber such as spinning, splitting of bicomponent fiber (In 1972,

Microfiber is a completely new generation of ultra-fine synthetic yarns and there are still wide range of opportunities to be explored in the design, production techniques and processing of microfiber.

Table 1 : Relationship between fiber linear density and classification

Fiber Count (dtex/f)	Fiber Classification
> 7.0	Coarser fiber
7.0 - 2.4	Medium fiber
2.4 - 1	Normal fiber
1 - 0.3	Microfiber
<0.3	Ultra-fine / super, nano comes under this.

'A microfiber is defined as a fiber of linear density approximately 1 dtex or less, and above 0.3 dtex.'

'Bellseime' invented by multiplying radial bicomponent fiber - 'Belima', dyeing, and finishing technologies). Artificial seudes like Alcantara and Amara are produced by dissolving method while, Bellseim by swelling process of splitting. Alcantara consisted of 16 microfibers inside and

Microfibers are finest form of all the fibers that can be produced altogether from man-made fibers.

such seudes are used for coats, jackets and furniture purpose. The fiber titled 'Cosmo-alpha' composed of 9 polyester microfibers and radial segment consisted of modified polyester. Ordinary fibers are blended with microfiber to cast soft feel and attractive appearance.

The history of microfibers dates back to 1940's with initial phase of 'Seeding' followed by 2nd stage known as 'growing and Blooming' started in 1960, later 'Fruiting' carried forward.

Characteristics of microfiber

Microfibers are finest form of all the fibers that can be produced altogether from man-made fibers. Being best reliable protector from wind and rain, microfibers particularly functioned for sportswear, as it is breathable also. Again, apparels made out of microfibers have glamorous flow, and also extremely comfortable to wear. Microfiber cloth retains their superior characteristics after washing or cleaning too.

- Usually, finer than delicate silk with ultra-fine density less than 0.1 dtex/fiber
- Tremendously drapeable with very soft and silken touch
- Microfibers are super-absorbent and have absorbing capacity of over 7 times their weight in water and take about one-third of time to dry up than ordinary fibers
- Microfibers do not create any problem to those suffering from allergies and hence, hypoallergenic
- For any fiber to be considered as microfiber, ratio of weight per 10000 meters of yarn to the number of filaments is considered and resultant value must be less than unity
- Able to sustain high pressure and feasible for wind proofing and water-resistant applications
- Categorical prints on fabric resulting in highlighted contrast
- Have comfort like natural fibers and hence, not sensitive to human skin, as they are spongy
- Light weight conjunction with appearance retention
- The rates of dyeing are higher even at low temperature due to greater surface area and reduced fastness to light.

Table 2 : Machine parameters for manufacturing of ultra-fine microfibers

Denier	>0.3 Denier	>0.15 Denier
Viscosity	>950 Poise	300 Poise
Spinneret Cross Section	$3.4*10^{-4}$ cm^2	$1.5*10^{-4}$ cm^2
Holes in Spinneret	140	<150
Ambient Temperature	200°C	150°C

Manufacturing techniques

Ultra-fine fibers can be extruded by reducing polymer output at spinneret and drawing same with high draw ratio. However, polyester cannot be extruded below 0.15 g/min, as there are chances of monofilament breakages during further process. There are many limitations to produce ultra-fine fiber less than 0.3 denier, by conventional means. So, various advanced techniques have been evolved for production of microfiber.

Direct spinning type

In direct spun type, microfiber is manufactured by direct-extrusion with proper controlled spinning and drawing dynamics. Polymers having dissimilar dynamic viscosities taken at particular temperature, polymer with lower dynamic viscosity tend to spin finer fibers, generating lower spin-line tension. Polymer quality demands for production of microfibers are very uncompromising and have to be very consistent in size throughout without any inclusion of foreign particles. Since, microfibers are high value products, off-quality polymeric chips should be avoided as raw material. For PET fiber, spin-line tension must be kept low so as to obtain finer fibers. The increase in take-up velocity and fiber line-length between take up device and spinneret increase spin-line stress. Therefore, special care to be taken to minimize die-swell formation by setting lowest possible melt viscosity at entrance of capillary. Also, during solidification, arrangement of spinneret holes must allow turbulence free airflow easing penetration of whole filament bundle. Severe hurdle is to attain evenness in density of fiber and that can be controlled with processing all filaments equally.

In direct spinning, single component ultra-fine fiber can be obtained without any later complications such as splitting into two components or removal of second component. Furthermore, formation of fluff and filament breakages are problems seen during direct spinning, also we cannot get high quality handle.

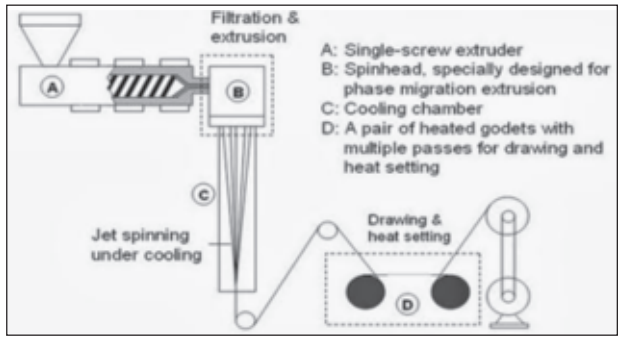

Fig 1 : Schematic representation of Direct Spinning

Conjugated spinning

Conjugate spinning yields homogeneous ultra-fine fibers and whatever technical problems were associated with direct spinning have been overcome by conjugate spinning. Okamoto (Toray) and Matsui (Kanebo) has invented extrusion of conjugate fibers with cross-section consisting con-

jugate components by modifying spinneret structure. Furthermore, conjugate spinning is branched in i) islands-in-a-sea type and ii) splitting type through spinneret and etc (*Fig 3*).

Alternately arranged polymer spinning

In this method, two component polymers of conjugate type are assembled as one and then extruded through spinneret. Generally, polyester, nylon and polypropylene are employed as island components while sea components such as polystyrene, copolymer of ethylene terephthalate are removed by dissolving it in a solvent after processing into woven or nonwoven fabrics. Whenever, PET is employed as island component, extrusion temperature is set to 275-300°C; micro-fibrillation takes place after macro-filaments have been processed into fabrics. Technology provides means of industrial production of silk-like fabrics, wiping cloths and fine filters, made of microfibers.

Splitting type or separate type spinning

In this mode of spinning, there is utilization of second component as well as first by splitting mechanically instead of removing second component by dissolving. Main point to be considered is how many divisions of two components can be achieved and depending on that commercial microfibers are

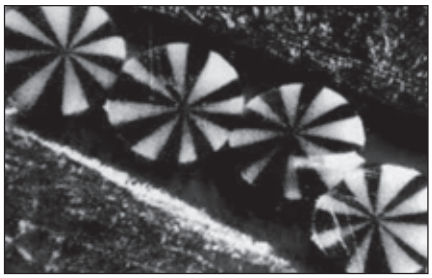

Fig 2 : Star-shaped split-type microfiber cross section

produced by special type of spinneret cross-section.

Toray and Kanebo initially employed *shaped spinneret hole while, + shaped cross section divides second component into four wedges. Teijin produces hollow-cylindrical conjugate fiber with petal-shaped cross-section. Introducing

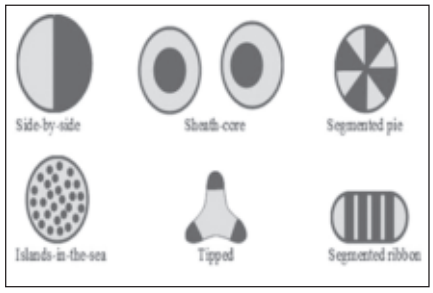

Fig 3 : Different types of conjugated microfibers

hollow shape,resulted in increased splitting number avoiding sharp and flattened edges. Since, PET and Nylon 6 have similar temperature range for extrusion and drawing, most of commercial products are based upon this combination.

Dissolved type

Generally, polyester and nylon microfibers can be produced by this manufacturing technique. In dissolved type, when filament is treated chemically with solvent, one component out of bicomponent fibers being dissolved and hence, removed. While, another component remains as microfiber, the final dissolved filament has linear density of about 0.5 dtex fineness. Commercial production by dissolving of bicomponent fibers reported to use of 80% of insoluble polymers which produce bicomponent filament up to 2dtex. Here, main confines are about selection of suitable polymer component which should be compatible and possess higher stability about rheological properties at extrusion temperature. The selection of material is so that, it should be non-toxic, non-polluting, and very importantly, recoverable aiming less cost of solvent and affordable soluble polymer. One of the combinations to form fibers is polystyrene (soluble) and polyester (insoluble).

Supervision of microfibers

Supervision of microfibers can be done upon specific criterions like, microfibers are able to grip six to eight times its weight in water and hence have high absorbing capacity. Whatever hair and lint particles are attracted to microfibers without letting dust particles attach, also absorb bacteria and germs to be used as germ or bacteria free purpose signifying electrostatic effect. Their characteristics will remain unchanged at water temperatures up to 200 degrees. Previously, polyester microfibers were commenced. But nowadays, nylon, rayon, and acrylic microfibers can be woven or knitted into very high-quality fabric construction. Moreover, being breathable and anti-wrinkling, enables ease of perspiration with good constructional stability and shape retention.

Applications of microfibers

Microfiber is an advanced technology with various applications in many industries as having magnetic attraction towards dust and dirt, with extreme functionality. Generally, cleaning with the help of microfiber products is quick, environmentally friendly, and easy (can eliminate or reduce drastically the need to use chemicals). Some important applications of microfibers are discussed here.

Constructional applications

Concrete is one of the important elements for all types of civil engineering projects like construction and repair of structures, highway pavements, bridge decks, wastewater pipes and decorative constructional panels. Since, plain concrete is having weak tensile strength, limited ductility and little resistance to cracking, which make them lag in functional aspects. As any internal crack inherently present and due to poor tensile strength results in propagation of such micro cracks leading to brittle

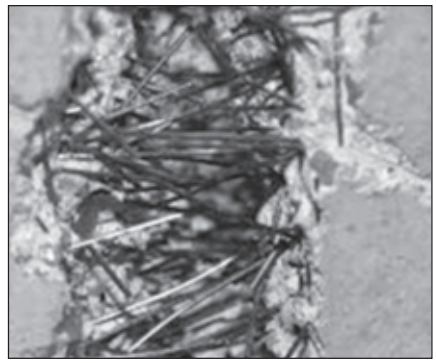

Fig 4 : Fiber reinforced concrete

fracture of concrete. In plain concrete and similar brittle materials, structural micro cracks get developed even before loading due to drying or shrinkage and when loaded, such micro cracks propagate to brittle fracture owing to effect of stress concentration. According to lot of trials and research work, it has been stated that mixing of uniformly dispersed fibers to concrete would act as greater resistant to drying shrinkage cracking, increase in compressive, tensile and flexural strength and improve its static and dynamic properties known as fiber reenforced concrete.

Combustion of textile fabrics is a complex phenomenon involving heating of constituent materials, gasification, decomposition due to constant exposure to heat and flame propagation.

Microfibers used as reinforcing material fibers aligned in parallel direction to applied load offers more toughness and tensile strength results in increased impact and shatter resistance, increased abrasion resistance and lower permeability of water. There some of the fibers that could be as reinforcing fibers are Recron, nylon, polypropylene, asbestos and glass fibers.

Reliance Industries Limited (RIL) has launched Recron 3s fibers with primary intention of improving concrete quality, it is a triangular shaped polyester fiber having cut length of 6 mm, 12 mm and 24 mm, diameter ranging from 33-35 microns with 6000 kg/cm^2 of tensile strength and about 45-55% of elongation rate available in cheaper cost than any other construction fiber. There are about millions of fibers forming a mesh in concrete at dosage of 0.25% by weight of cement. Mortar along with water: cement taken at specific ratio in conjunction with Recron microfiber and sprayed simultaneously in reinforcing cement boards. Super plasticizers are added to concrete, to lower the water: cement ratio, and improve volumetric stability of mixture. The use of Fiber Reinforced Concrete (FRC) prevents formation of micro cracks and their further propagation, restricts water penetration and permeability, imparts flexural strength with better extensibility and enhances deterioration resistance of concrete surface.

Medical applications

Microfiber nonwovens being relatively high versatile incorporating various mechanical properties, indispensable, lower amount of lint and less cost of production enables maintaining high levels of hygiene. The product comprises of different functions like receive fluid, imbibe it rapidly, holding it for a period of certain time, not letting fabric liable for soiling, mask odor and be conventionally disposed. Market segment for products under microfiber-based hygiene materials incorporates baby diapers, nappies branched under diaper category. While, sanitary napkins, feminine pads, sanitary towels comes under feminine hygiene and lastly, adult diapers, guards, shields, undergarments covered under adult incontinence.

Light weight nonwovens, less than 50 g/m^2 are beneficial for hygienic products with required performance and that too at low cost. The softness adjustment of outer covers can be done by adjusting spinning speed, microfiber components to be used and diameter of filament. In case of future developments, lots of research are subjected to develop increased levels of comfort, absorbency performance along with discretion. Recent trend is in the use of microfibers processed into nonwoven material by means of needle punching or hydro-entanglement.

Surgical masks are made of very fine middle layer of microfibers covered on both sides by either an acrylic bonded parallel-laid or wet-laid nonwoven. The application of such surgical masks demands some requirements like high filter capacity, high level of air permeability and most importantly light weight. While disposals used in operating rooms are hydro-entangled microfiber nonwovens. Furthermore, hydrophobic finishes can be applied on microfiber nonwovens to achieve anti-bacterial characteristics.

Table 3 : Hygiene applications in medical sector

Product application	Fiber type	Manufacture system
Surgical clothes Gowns, caps and masks	Polyester microfiber, Cotton Viscose, polypropylene	Nonwoven, woven
Surgical covers and drapes	Polyester microfiber, polyethylene	Nonwoven, woven

Flame retardant applications

Textile industry satisfies many of our basic and essential needs by means of fabric - personal apparels, home upholstery, coaching of seats and decor for public spaces. But, among all possible causes of life and property damage, fire damage is crucial one to be considered. Combustion of textile fabrics is a complex phenomenon involving heating of constituent materials, gasification, decomposition due to constant exposure to heat and flame propagation. Along with functional properties of fabric and applied finishes, various garment characteristics also influence on thermal protection and insulation. For fabrics produced out of thermoplastic- fibers, higher fabric thickness tends to signify much severe effects and condition gets reversed in case of cotton, wool and other non-melting fibers. Fabric without any fire retardancy safety will not be able for any applications safeguarding protection against fire when any textile material is heated externally. To overcome this problem, a high-performance flame-retardant polyester microfiber has developed. Flame retardancy of materials is generally expressed as oxygen index.

$$(OI) = (OI)_m + f(FR) \quad \ldots (1)$$

where,

$(OI)_m$ = oxygen index of virgin material

$f(FR)$ = function of flame retardant

Polyester microfiber has glass transition temperature (Tg) of 80-90°C,

melting temperature (Tm) of 255°C, pyrolysis temperature (Tp) 420-477°C and combustion temperature (Tc) 480°C with 20-21.5% limiting oxygen index (LOI). While nylon 6 microfiber has Tg of 50°C, Tm about 215°C, pyrolysis temp. is 431°C with 20-21.5% LOI value.

Recron FR is a special group of flame retardant micro fibers and yarns intentionally developed to provide viable permanent safety solutions along with comfort properties in any applications and at every instance of time. It is manufactured with modification in polyester structure that contains a flame-retardant component attached to molecular structure. It is a circular shaped microfiber available with cut lengths of 40 mm, 44 mm and 51 mm and about 1.5, 2.0 and 3.0 denier fineness. Flame-retardant finishes for fabric produced from polyester microfiber reduce thermoplastic behavior and ultimately promote formation of char so that drops get extinguished away from igniting flame source. The pyrolysis and gaseous combustion of PET incorporating poly(4-bromostyrene), (polyvinyl bromide) and (polyvinylidene bromide) applied via tropical treatment or radiation shows effective release of hydrogen bromide that is capable of restricting combustion reaction. The physical and chemical bonding of phosphorous with polyester matrix make fire retardancy lasting permanent; components embedded inside structure of matrix do not let fire to spread over. Products made from these microfibers are completely flame retardant, light fast, durable over long period of time, easy to care and has multiple applications in home textiles, transport sector and hospitality materials. Flame retardant polyester microfiber is an environmentally fiber, and do not require additional application of flame-retardant finishes over peripheral surface like normal combustible fibers ensuring protection against external agents with ease of chemical structure of polyester fiber. Important specialty of this fiber is components do not split up even at high pressure and temperature, maintaining its inherent properties during processing, retains safety factor even after repeating washing treatments. There are enormous technical applications of Recron FR in multiple fields like upholstery, furnishing fabrics, curtains, drapes, tent, tarpaulins and sofa-covers.

High performance filter fabrics

Considering ultrafine and compacted structure, microfiber offer excellent filtration applications for both air and fluid along with solid and liquid materials. Nonwoven microfiber filters in combination with high electric voltage, provide permanent polarization to the nonwoven, separating dust by attracting charged particles and hence, filtering them out. Microfiber filters are generally, characterized by their ability to sustain high water passage speed, high extraction abilities, retaining particles up to micrometer dimensions and ease of cleaning settled micro-particles from filter. For needle felted filer fabric, area density is usually in the range of 50-150 g/m^2.

Fig:5 : Meltblown microfiber filter fabric used for face mask

Due to larger number of pores per unit area, microfibers provide efficient filtration, and require much higher degree of opening and carding. Most of fibers utilized in dust collection are of circular cross-section, irregular, multilobal-shape and peanut shaped. One sector where microfiber fibers are significantly employed for filtration of metal ore concentrates such as copper on horizontal belt filters. For some arduous applications, area density of needle felts is generally kept about 800-1000 g/m^2.

Microfibers for cleaning

Microfiber products unlike other cleaning fabrics, 'scrape' the dirt or stain from surface and store dirt particles inside it and do not let particles spread randomly. The key factors for microfiber products are their functionality, ease of use, convenience and disposability. Product innovations like antimicrobial and antibacterial wipes have made emphasizing impact on marketplace maintaining rapid growth momentum.

For ease of understanding, contribution share of wipes in household sector is broadly classified into three categories as cleaning (48%), wet floor (44%) and furniture (8%). Microfibers of air laid, thermally bonded, especially spunlaced and spunlaid material, have become multi-billion-dollar markets at end product level, in the market today.

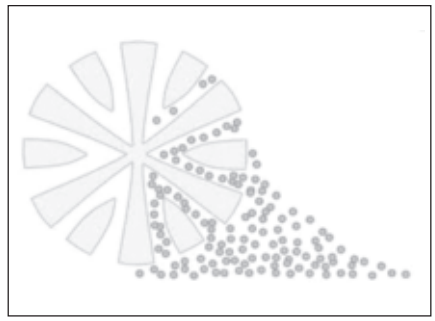

Fig 6 : Cleaning phenomenon of microfiber cleaning cloth

The dust and dirt particles from surrounding area are magneted towards microfiber wipes and get trapped inside porous region. The particles do not let levigated and instead, held firmly through pores. Whenever the wipes are washed, dirt particles get washed off leaving pores again left with vacant voids and wipes can be used for next cleaning purpose.

Household cleaning wipes involve general cleaning wipes, wet-floor wipes and furniture polishing wipes. Thus, household cleaning is broad sector with various products from kitchen and bathroom to automobile cleaning and maintenance. In recent times, household cleaning has become the largest consumer of wipe industry.

Sports textile

Nowadays, people are considering sport as a vital part of their day to day activity, as it helps to maintain them both physically and mentally fit. Thus, there is enormous increase in quality as well as quantity of sportswear consumed

globally. Importantly, moisture and heat management are key points that have to be ensured to consider textile product for sports applications, So as to provide thermo-physiological and tangible comfort. There are four types of clothing comfort for any active sportswear as,

- thermo-physiological comfort,
- sensorial comfort,
- mobility
- psychological comfort.

Microfibers are commonly used in sportswear and are characterized by excellent resistance to dirt, and most of organic solvents like alkali. According to researches, athletic comfort is acquired by the number of fibers per cross section and techniques of spinning process. Mostly, knitting is common

Fig 7 : Performance improvement by wearing proper sportswear

technique employed for sportswear manufacturing due to process flexibility. Developments in synthetic fibers have opened up enormous avenues for their use in sports textile to cater to specific demands.

Dryarn is a completely recyclable polypropylene microfiber developed by Aquafil. The fabric made of Dryarn has soft handle, high capacity of thermo-regulation, light weight and also dries quickly. Another benefit is bacteria can not settle on fiber surface that restricts further bacterial growth and ultimately unpleasant odor associated with it. Kanebo Ltd has developed a nylon microfiber, 'Killat N', whose hollow segment is about 33 percent of each filament. The hollow portion help in capillary action for liquids and warm feel due to air pockets. The yarn is spun as bi-component filament with soluble polyester copolymer as core material and nylon as a sheath material. It enables good water absorption and heat retention. Triactor is polyester filament developed by Toyobo Co. Ltd. Since, polyester is hydrophobic in nature also, when cross-section is changed from circular shape to Y-shape, it helps to faster release perspiration by capillary action and hydrophobic nature of large filament surface enables faster drying of sweat.

Table 4 : Sports and functional requirement

Sports	Functional requirement
i) Swimwear and costumes for skating	- Stretchability and opacity
ii) Uniform of baseball and football players	- High tenacity, abrasion resistance, stretchability
iii) Cycling costume	- Low fluid resistance to air
iv) Cricket, baseball uniform, tracksuits	- Fast drying, cooling, sweat absorbing
v) Skiwear and rainwear	- Moisture vapour permeability and water proofing

Various studies have revealed that 100% polyester microfiber knitted samples showed better physiological properties and comfort than 100% cotton fabric, and blended fabric (65% polyester, 35% cotton). Polyester microfibers and Renova are the common types of microfiber that are used in sports textile. Primarily, high density polyester microfibers appeared in 1985 having light weight and high strength. The microfiber has ability of temperature transfer, moisture and significant softness. Polyester Renova is alike wool and used in applications of ladies coats, as fabric produced from such fibers have better functional properties with additional smoothness, durability, luster and surface control, etc.

In an article titled 'Enhancing Functional Performance of Sportswear Fabrics Using Polyester Micro-fibers Yarns' by S Yahia, F A et.al, the author has experimented with about 24 samples woven from polyester microfiber yarn. The samples were woven with two types of polyester yarn: microfiber spun polyester yarns as weft and microfiber continuous filament yarns in both warp and weft followed by two types of structures with plain 1/1 and another 2/2 twill were employed for back layer and six various structures were used for face layer. Specifically, all samples produced with 60 Ends/Cm and 50 Picks/Cm. All the samples were kept in standard atmospheric condition after weaving for about 24 hours and evaluated by carrying out tests for fabric weight, thickness, tensile strength, stiffness, air permeability and fabric drying rate. The results of all tests pointed at, high significant effect of back weave structure plain 1/1 with variable face structure upon weight of sample, tensile strength and percentage elongation in warp direction. While 2/2 Twill as back structure had crucial effect on tensile strength and elongation.

Athletic comfort is acquired by the number of fibers per cross section and techniques of spinning process.

Applications like active wear, denim, formal wear & women's wear

Reliance R I Elan Fabric 2.0 developed fabrics made up of SuperSoft superfine fiber Spun yarn. Denier of fibers used to manufacture these spun yarns is in the range of 0.6 to 0.8 denier and Powered by SuperSoft superfine fibers with soft touch. Fabrics made by these are having soft and luxurious feel, excellent fabric drape and easy care also used in applications like active wear, denims, formal wear and women's wear.

Conclusion

Microfiber is a completely new

generation of ultra-fine synthetic yarns and there are still wide range of opportunities to be explored in the design, production techniques and processing of microfiber. In addition with common raw materials, polyester, nylon, polyamide, there is vast scope to include cellulose as raw material. Since, fabrics products produced from 100% cotton fibers or other natural fibers have some shortcomings in terms of moisture management, imparting thermal discomfort. On other hand, products made from microfibers have varied simulations of natural fibers, transports perspiration effectively and quickly away from wearer's body due to higher water vapour permeability. So, microfibers have vast scope of applications in sports textile, upholstery, cleaning cloths, high performance filters and technical textiles (construction reinforcement, flame retardant fabric) and also in applications like active wear, denims, formal wear and women's wear by its better properties like soft and luxuries feel better moisture management, excellent fabric drape, easy care etc. However, it's essential to control such delicate yarns in downstream processes like twisting, sizing, warping, weaving, dyeing and finishing.

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Evonik boosts production of nanoparticles

German speciality chemicals maker, Evonik has announced that its multi-purpose silicone and nanotechnology manufacturing facility in Geesthacht, Germany has been further boosted with the completion of its new multi-purpose reactor. The new plant will help to meet increasing demand for its high value growth specialties products, including for example the acrylate resins filled with nanoparticles used in dentistry applications such as component fillings or artificial teeth.

Specifically developed to produce products like 'Nanocryl D' which increases the service life of expensive dental prostheses by providing abrasion resistance, the unique set-up of the small-scale vessel enables quick changes in production to meet customer requirements. This flexibility also allows for further adaptations to quickly switch production to other attractive growth markets, like electronic applications.

'Previously, our team at Geesthacht could produce the specialist materials our customers needed in our laboratory, but production capacity was unable to keep pace as demand for these products has grown,' explained Mr Stefan Plass, Head of Evonik Interface & Performance. 'Additionally, our customers are increasingly looking for more customised solutions, so to meet these growing requirements, we strengthened our nanoparticles capabilities with the investment in a new small-scale multi-purpose reactor,' he added. Evonik said moving small volume specialties to the new plant would free up laboratory resources and capacities for the development of other products outside the usual silicone and nanotechnology speciality chemical products.

The latest investment into the construction of the new small-scale reactor at Geesthacht follows Evonik's previous investment in its silicone and nanotechnology at the site.

In addition to the new acrylate resins filled with nanoparticles for use in dentistry applications, other products produced in Geesthacht include curing silicones and silane-modified-polymers (SMPs) used as binders for adhesives and sealants in parquet adhesives, adhesives for wound care and other medical applications.

Eco-friendly handlooms of India

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Ever since human civilization began, the weaving of warp and weft was always a source of inspiration for the human mind. Various customs annexed with threads existed in our country, for instance, thread wrapped on the wrist of a person, or around a tree was believed to protect them bad omen and negative vibrations or to wish for something good. Similarly weaving was a major occupation across the country, especially with the cotton and silk. In early days, a variety of cotton fabrics were woven, ranging from coarse, strong gauzes to the finest of muslins. In addition, each State owns a unique weaving or craft tradition that depicts the resources available, beliefs and lifestyle. For instance, the Kashmiri/ Kani shawl of Himalayas, is described as patience woven in thread, depicting the fact that only one inch can be woven per day indicating how laborious masterpiece those textiles were. Another popular handloom is the muslin, with an impeccable quality. It is described that a six-yard muslin sari can pass through a wedding ring or can be kept folded in a match box: a 100 yard can pass through needle eye, portraying the fineness of yarn quality.

Fast fashion being the current trend in textile production, it is significant to slow down and look deeper into our roots, which have impeccable textile making techniques.

Metaphor of Indian handlooms

Weaving was a community activity, starting from cleaners, yarn maker, weavers : all from the same family or few families connected as one for the profession. The skill is transformed between generations, where some have survived, many have become extinct. Among various muslins, jamdhani, the weaving of floral patterns on the muslin fabric has survived through various stages now. Phuti karpad, finest quality muslin, made near the Meghna river (Bangladesh) has become extinct 160 years before. Among various efforts, it is noteworthy to mention the efforts taken by the Craft council of Kolkata, which spent decades to revive the traditional muslin of 500-600 thread count. The moment calls for such initiatives to promote Indian handlooms, and some interventions have been done to revive lost weaving finesse. Recently, the real banaras fabrics was reinvented in the Lakme India Fashion Week. Also, in 2016, 'Dhaka Muslin: Our Story', and a preview of a documentary video, 'Legend of the Loom' was launched to create awareness and spread the glorious past of the muslins. In the evening, there was a sound and light show, that had runway models in saris in the traditional muslin.

As a means of documenting the greatness of Indian Khadi, an exhibition was organised by a team consisting of Mayank Mansingh, Designer and curator, Poludas Nagendra Satish, who actively work towards empowering rural areas through Handspinning, Designer Rakesh Thakore, and Mrs Vijayalakshmi and Mani Chinnaswamy from Ethicus

Fig 1 : Display of Handlooms during the 'Meanings, Metaphors Handspun and Handwoven in the 21st Century' exhibition in Coimbatore, Tamilnadu during 21-27 January 2019

(a) (b)

Fig 2 : a) Booklet holding the different handloom varieties b) Visual evidence of the fineness imbibed by the material.

brand, Ally Mathan, from Registry of Saris, Aishwarya Pathy, Indian Design forum. The event was conducted in Coimbatore, Tamilnadu India during January 2019, which showcased very coarse to very fine handloom fabrics.

Among various handlooms, muslins are known for its functionality and weaving excellence.

The muslins rightly termed as woven from air and quality resembling dew drops, were thematically displayed in the same manner *(Fig 1)*, as though the fabrics were floating in the air.

It is stunning that more than 108 textures indigenous to India was possible in handlooms, most of them extinct now. The display had a booklet *(Fig 2)*, which was a collection of Kadhi, made in various yarn counts, textures, natural dyes, and another section of suvin cotton from fibre to clothing. A curatorial display of traditional patterns of checks, polka dots, golden border, temple border, rudrasham and indigo dyed had been a visual that one can never forget. The exhibition open to public, created a huge awareness among school and college students, and organic cotton seeds with yarn was also given as a souvenir to all the visitors. Certainly, the government schemes like Today Made in India, Skill India, e-commerce, social media platforms have been effectively working towards reviving and promoting handlooms of India. Many efforts to revive muslin weaving in West Bengal and Bangladesh have been taken by the initiatives government, non-governmental organisations and research communities.

Muslins - an exotic Indian handloom

Among various handlooms, muslins are known for its functionality and weaving excellence. During Mughal reign in India the muslin fabric gained royal patronage and was worshiped as a sign of nobility *(Fig 4)*. The quality was top notch due to the careful handcrafting at each stage of fabric making. Certainly, the Indian soil quality, moisture level, environmental conditions in which the cotton was grown was ideal for making fine cotton clothing. The plucking of cotton was done only early in the morning that helps in locking moisture and softness due to the right humidity. Also, hand spinning for the muslin clothing involved women who with their thin, long and delicate fingers, made the fine quality, strong yarn. Further with compassion and human touch at each level the final muslin cloth is made.

Various literature supports the exuberance of muslins that is of Indian origin. The second century BC figures depict the transparent clinging fabric on their body. First reference of muslins points at the Chanakyas Arthashastra during 4Th century BC. Also, the paintings of Josephine Bonaparte *(Fig 5)* Nepoleans first wife, can be spotted wearing muslins. It is mentioned that there was a tradition that noble ladies dampened the muslin to make their body more visible. Yuan Chwang, a Chinese traveller describes the handloom fabric as a cloth that is like the light vapour of dawn. Also, during 1875 when the Prince of Wales came to Bengal, it seems he ordered 30 yards of muslin, of finest quality, where one yard weighed just 10 grams. In the book written by Pandit Jawaharlal Nehru, 'The Glimpses of World History' he mentions that 4000 year-old Egypt mummies were actually wrapped in Indian muslins.

Fig 4 : Mughals wearing Muslin

It is interesting to know that muslins was used by everyone in the community from the rich to the poor. There were huge varieties of malmal which was called by different names. Fine quality was Malmal and Alaballee, the elegant looking Khasa, Abirawan which was compared with the running water, Shabnam referred to the morning dew, Rang with netted texture, Tanzib that is used in adorning body, special quality Buddankhas, the appealing Nayansukh, turbans from Seerbund, Shirts from Kumees, stripes called Doorea, Charkona in checks and

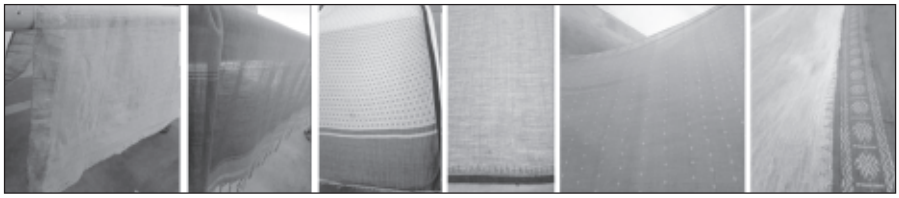

Fig 3 : Images from the exhibition showcasing the golden border, indigo dyed, checked pattern, temple borders, dotted pattern and rudraksha motif

Jamdanee as florals figures and the Jhuna muslins for the dancers. Among these varieties, malmal is expensive as the production time is sometimes upto 6 months and used exclusively by Nawabs and European emperors.

The muslin production was at pinnacle, when British exported Indian muslins to their country and constructed items like scarf, handkerchief, undergarments, shirt, skirt, frock, kids garments and home textiles. Decades passed and British started to import their mill made clothing in India, which directly hit the Bengal textile industry that was supplying cotton cloth to the world. It is reported that during 18th century British rulers had almost monopolised the textile trade with Bengal and removed all the European and Asian traders. Flood, famine was already affecting the weavers, and industrial revolution in western nations resulted in more fabrics at cheaper quality and price. Adding more pressure, they had imposed various tariffs, and exploitation was common those days: weavers wages were also cut down drastically. This made the situation worse, when Indian cottons market declined, weavers disappeared and Indian muslins also faded away.

Fig 5 : Princess Josephine (wife of Napoleon) in Muslin

Handlooms crafted with hands and fingers are believed to have positive vibration, additionally it promotes prosperity and good health to the wearer.

Repositioning handlooms for self-expression

Handlooms always use natural fibers like cotton and silk, to create a textile material that has zero carbon footprint, signifying the ecofriendly nature in its production. It needs low capital investment, less power consumption, eco-friendly, versatile and flexible. The major objective of today's business is focused on sustainability that is believed to be the future, and handlooms synonymously are the best example for sustainable textile. Handlooms crafted with hands and fingers are believed to have positive vibration, additionally it promotes prosperity and good health to the wearer. Today eight million families in India are directly and indirectly connected with looms and purchasing them can be observed in varied perspectives.

Buying handlooms expresses a concern for environment and production of handlooms does not deplete scarce resources. It provides self-employment to women and men, besides, exclusive designs can be hand made. Handlooms are committed textiles for harmonious world, that aids in keeping heritage intact and humanity must be proud of such an ar. Handloom was done as a social activity which used to help in community building, and now, repositioning handlooms is essential for self-expression and sustainable future.

Challenges: fast fashion and handlooms

Each State in India has a unique design, and weaving technique, that, according to experts, by looking at the fabric one can easily make out the region from where it is made. Today, it is very saddening that various duplicates are available, inside and outside the country quoting the high price of handlooms. This is the reason for the widespread fast fashion culture in the world. For instance, a pure kalamkari fabric on a six-yard silk sari can cost Rs 25000 and its imitation print on a polyester sari can be made at Rs 1000-5000. As a result, the customers are cheated by duplicate products and imitations which are available in the same design but at unbelievably cheaper price. Consumers tend to buy this and repeatedly shop similar items for its cost effectiveness. This has resulted in the handloom weavers be in the poverty line.

The unbelievable craftsmanship, time, physical hardships, investments, labor charges invested into the making all goes in vain. Stocks keep adding in the weaver's house, unable to find buyer, results in poverty. Adding to this, majority of the consumers lack awareness and is unable to find the difference between real and duplicate materials. In the production side, lack of quality check, certification, standards and poor government norms to fight against these fraudsters are some of the setbacks that led to the loss of many traditional weaving forms in India.

Methods to promote handlooms

The are many weaves and art forms that have been lost in the journey and it is now important to save the weavers and the art. Some of the steps are listed below;

- Public and retailers should be given awareness about the Indian handloom product and Geographical Indication (GI) tag
- Promoting handlooms as national fabric and everyone in the country should wear it twice a week or atleast during major celebrations in the country
- Handlooms should be worn by every government official on important national occasions
- School uniform, college and Universities official clothing can be made from handloom material
- Twice in a year, competitions like

quiz, slogan writing, essay writing, dance and drama promoting the rich tradition of handlooms can be conducted frequently in schools and colleges that can increase the awareness

- Designing more indowestern clothing for adolescent can widen the market, besides, more value-addition can be applied on handlooms
- Export market can be increased while reviving natural dyes on handlooms that was an age old practice in India
- Handlooms can be used for suitable applications in technical textiles
- Government can give more facilities, resource centres, and assistance to the weavers to increase productivity and promote sales.

Conclusion

Handlooms were always more than a garment, but as a representation of culture, status, spiritual affiliations, personal expression of ones self, nativity, power, position etc. There is a popular saying "the more regional we, the more international we go". In a cultural shift that is in getting everything at a faster pace, it is important to slow down and look around. Indian handlooms are more than textiles, and one can be proud that no other country in the world has so much diversity in their textiles.

Everyone, especially Indian, should pledge to wear sari/handloom atleast twice a week and a revolution can start from there.

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Quality characterization of different types of leathers used in garment industry

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Leather is obtained from animal 'hides or skin' that had been changed over by processing the leather by chemical treatment, known as tanning to a steady state. The main hides and skins utilized in assembling of cowhide and sheep skins, dairy cattle covers up, goat skins further more, lamp skins. Leather is a ductile material which is made from hides and skins of animals[44]. In the leather sector, the term 'hides' refers to the skin of completely grown or matured animals like cow, horse etc. Whereas the term 'skin' refers to the skin of immatured or smaller animals like sheep, calf, pig etc. These leather hides or skins have three layers in its origin and structure is (i) Outer layer called Epidermis which is a thin layer made up of epithelial cells, (ii) Middle layer called corium which is a thick layer that are changed into leather by the process of tanning, (iii) The inner layer is a flesh layer which is a sub-cutaneous adipose[4].

Leather manufacturing is done from 'hides or skins' of the animals in three different steps and they are (i) Evacuation of unwanted elements from the skins like unwanted tissues, hair, fat etc. but leaving a concentrated group of highly rich protein collagen strands that is incredibly softened and interspaced with some water. (ii) The second stage is processing of leather called tanning. Chemically treating the hides or skins with element is called tanning that dislodges the water and mixed well along with the water and afterward coats the collagen strands. The process of tanning makes the leather rich in heat resistant, hydrolysis which causes decomposition with water and multi cellular organisms[60]. (iii) Finally, finishing has done to get appropriate properties like moisture, lubrication, aesthetic appearance and thickness. Hence, leather made from hides and skins that have proteins combined with tannings, finishes, dyes, moisture and less quantity of oils. According to the different types of finishes given to the leather in the final process, the different types of leathers are obtained[9].

There are various kinds of leather types available in the market which gives profits according to its own unique characteristics and its applications[13]. Several different types of leather are categorized into various kinds of leather categories. The different types of leather qualities, cuts, leather grades, leather finishes and also its types varies according to its resources like animal hides, fur, faux and vegan leathers. Some of the differences are mainly due to the process of manufacturing leather and different types of finishing processes. (Gupta S (2018)).

Leather is a ductile material which is made from hides and skins of animals. The different types of leather qualities, cuts, leather grades, leather finishes and also its types varies according to its resources like animal hides, fur, faux and vegan leathers.

Some of the other variations are based on the usage of raw materials like animal hides, vegan leathers and the cutting process of leathers. The quality and the characteristics of the finished leather

After retanning, leather can be softened further in a dry tumble drum, which often improves the natural grain.

depend on where the resource material comes from. The quality of the leather also varies by different factors like the type of animal, food they were taken care of, measure of activity they had and the environment they lived in. Animal hides are a natural characteristic material, and subsequently, exceptionally affected by the existence of the creatures that they come from.

Leather hides are naturally made up of few layers like the grain, the grain and corium junction, corium and flesh. These layers along with hair or fur are formed as a protective barrier for the animal to keep the internal parts more safe. It also acts as guards to protect itself from external factors like water, sun and abrasions. The outermost layer of the animal hide consists of tight and dense fiber is called grain. This is the surface which is directly exposed to the natural elements like sun, air and rain which is usually strong and act as a protective barrier. The grain and corium junction layer is the place where the outer layer of the animal hides blends with looser fibers in the corium. The layer which is mainly made up of collagen fibers is called Corium. These fibers are more open and looser compared to the grain layer. This corium layer is the thickest of all the other layers which is highly used for manufacturing of leather. Then the flesh part mainly consists of fatty tissues and muscles. This part of animal hide is not much valuable for making the end product of leather. The resource material for making leather is usually obtained by removing and splitting the layers with different quality characteristics that are right above the flesh part[38].

During the manufacturing process of leather, different types of finishes are given to the leather that can be used for different end-uses. These varieties of finishes are given to improve the texture, color, flexibility and appearance of the raw leather. These finishes can be done in different forms like dyeing, coating, waxes & oils and in designed patterns. The leather with any of these finishes is called finished leather. These leathers are not only used in garment sectors but also in upholstery, gloves, bags, shoes, covers, holsters and sheaths, saddles and in decorative products. Leathers are varied based on the finishes given to the leather. Some of them are aniline leather which are also called natural nappa, semi-aniline leather, pigmented leather, finished split leather, oily pull-up leather, antique grain leather, Nubuck leather, suede leather[34].

The leather garments are the most greeted products among the high street, it is highly difficult to ensure that the characteristic performance of these products meets the customer expectations. Though it is being used by the elite people in terms of price point, customer's perception still depends on the quality parameters as they are made of leather. So to make sure that the performance of the leather garments meets the expectations of the customers with some range of tests that are designed to evaluate garments and characterize on the basis of tear strength, tensile strength, thickness, colour fastness, water repellency, etc[48].

Materials and methods

Leather manufacturing process

There are a wide range of leathers used in garment industry and accordingly numerous variations in the manufacturing process, however the main five processes of manufacturing leather are cleaning, tanning, retanning, milling and finishing[42].

Cleaning

During the transportation of animal skin and hide to the tannery, skins and hides are preserved with the help of salt and sometimes transported fresh with the help of refrigerating units. In this process, dust, hair and the salts used for preservating the animal skin are removed along with degreasing of animal hide. This process is also known as wet processing. Once the cleaning process of animal skin and hide is completed, they are classified into full grain, top grain, Nubuck and suede leather.

Tanning

The protein structure of the hides and skins is stabilized during the tanning process, making them more resilient, chemical resistant, and less susceptible to decomposition; the pelts are then converted to leather. Chrome, vegetable tannins, and chrome-free alternatives have traditionally been the primary tanning methods. After tanning, if the hides were not split during the beam house process, they are normally split. After tanning, leather tanned with chrome is called 'wet-blue,' leather tanned without chrome is called 'wet-white,' and leather tanned with vegetable tannins is called 'vegetable or veg-leather.'[68]

Retanning

The final character of leather is determined by the retanning process, which involves dyeing for colour and fat liquoring for softness, fullness, and touch. It's here that the final product's specific characteristics will be calculated, whether it's for automotive or aviation seating, boots, clothes, or bags and leathergoods. The leather is referred to as crust after it has been retanned[42].

Milling

After retanning, leather can be softened further in a dry tumble drum, which often improves the natural grain structure. Leathers softened in this way are also referred to as "tumbled," and can be distinguished by their soft handle and naturally grainy appearance.

Finishing

Many different surface finishes can be applied to provide defense, create unique fashion effects, or to improve the feel. Coats, dyes, waxes, and oils, as well as embossed or printed patterns, may all be used. Once completed, leather is

referred to as 'finished leather.'[21]

Types of leather

Cowhide leather

Cowhide is considered a superior choice than other forms of leather in terms of weight, longevity, hardness, and ruggedness. It's used to make wallets, belts, and shoes, as well as men's jackets, especially biker and motorcycle jackets, which are typically made of cowhide leather. Aside from the apparent benefit of hot, cowhides come in a variety of properties, ranging from the finest, which is often used in its natural state and colour, with surface fur removed, to the less desirable, which is often dyed and treated to mimic other skins, such as tiger or zebra.

Sheepskin leather

People like sheepskin leather because it is fluffy, sleek, and light in weight. It's also appealing because it's stretchy and adapts to the shape of the body over time.

Sheepskin is widely used in garments and is favoured by both genders due to its soft texture. Sheepskin is perhaps one of the most intriguing topics in this section of leather styles depending on animal. Sheepskin is sometimes tanned with the fleece preserved, not only for leather but also for fur.

Lambskin leather

Lambskins and calfskins are known for their smooth and supple appearance, which elevates them to the top of the luxury product list, since they are suitable for high-end leather coats, shoes, and other accessories.

Lambskin and calfskin, unlike older animals of the same breed, provide a thinness and versatility that makes them the first alternative in terms of durability, look and quality.

Goatskin leather

In comparison to cowhide, goatskin leather has more lanolin, making it smoother and suppler to touch. About the fact that this is a debatable subject, goatskin as a leather sort is unquestionably soft, breathable, and comfortable to wear. Sheepskin is softer, lighter, and more compact than goatskin, but goatskin is more robust.

Described by the distinctive ridges on the surface, goatskin is used by many major brands for making leather bags, purses, and jackets simply because of its consistency and texture, as well as its light weight in contrast to cowhide. In comparison to cowhide, goatskin has a much improved look and is more flexible, making it a front-runner in leather, footwear, and other applications.

Types of finishes

Aniline finish

An aniline finish can only be applied to the finest quality of full grain leather. This is due to the fact that the grain would be revealed and must be free of blemishes. Since aniline can only be made from the best skins, only about 5% of them are suitable. As a result, the leather looks and sounds much superior to most finishes.

Aniline finishing entails the application of aniline dyes, which are water-soluble pigments. Rather than the thick opaque coating left by other finishes, this gives a stain-like appearance. The aim is to bring out some of the leather's natural colorings and shapes, such as fat lines and wrinkles. A pigment-free paint or glazing is often used after this. When examined under a microscope, pores should be seen clearly. Aniline leather has many advantages. The leather is able to breathe and adapt to body temperature easily due to the lack of a finish. It's ideal for clothes, shoes, and small accessories because of this. It also ages well, acquiring a much-desired patina over use. Since this form of high-quality leather can fade under direct sunlight and is vulnerable to staining and soiling, it needs special care. Micro pigments can be used to help mitigate this and have some protection. This is known as 'aniline plus' or 'protected aniline.'[15]

Semi-aniline finish

Semi-aniline leather has a thin protective/corrective coating that leaves the grain bare. It's very common for hides to have a few unsightly blemishes due to differences in grain and colour, bruises, bug bites, and other wear and tear. To correct this, a thin coat of finish with enough opacity to obscure differences but not covering the leather's natural grain may be added.

With just a limited amount of dye, semi-aniline finishes are added to full grain leathers. The pigment adds toughness and stain resistance to the leather, allowing it to withstand more wear than true aniline leather. This finish has a faint sheen to it, but it also has a high-quality appearance. It is immune to sunlight and water damage, unlike aniline leather.

Pigmented full grain leather

About the fact that this style of leather finish requires a thicker layer of material to cover features than semi-aniline finishes, it is still made of high-quality full grain leather. To mask defects, a resin-based pigment is used, but it also has the look and feel of a high-quality component.

Unlike the other finishes, this one masks the normal colour differences in the leather and does not reveal the pores.

Pigmented leather finish is one of the most common high-quality leather finishes.

Instead, the paint and surface are uniformly and evenly pigment-coated, resulting in excellent light fastness and stain tolerance. It has less breathability, which is often offset by perforation.

Pigmented leather finish is one of the most common high-quality leather finishes. While it is not as soft as aniline and semi-aniline leathers, its hardness and thicker top coat allow it to withstand more abrasion with less maintenance. Pigmented full grain leather is ideal for a wide range of applications, particularly those that see a lot of use.

Suede

Buffing lifts the corium fibers to create an even and short fibre, or "nap" finish, using abrasive action. Buffing the flesh side, or inner portion, of the hide completes the lifted nap. Suede can be made from either side of a flesh split or from the flesh side of grain split leather.

Suedes are both appealing and durable, with springy fibres that easily return to their original location. This ensures there are no 'finger marks' or 'two-way rubs' visible.

Suede is extremely robust while also maintaining a pleasing appearance and softness to the touch. It's ideal for sneakers, hats, and gloves, among other things.

Nubuck

Nubuck, also known as velvet suede, has a softer buff than suede and is buffed on the leather's grain base. Snuffing is another term for this. Surface collagen fibres are finer than corium fibres, resulting in a finer sleep. The nap is then rubbed or padded with a fluffy wheel to give it a velvety, lustrous appearance. Often wax, grease, or oil is used. Oil nubucks are the name given to these leathers.

Suede lacks the 'two-way rub' or 'writing effect' that nubucks have. Suede is made of lower-cost, lower-quality leather, whereas nubuck is made of higher-cost, higher-quality leather. As a result, it's softer and longer-lasting. Although both have common uses, nubuck is for those who are able to pay a premium for the extra softness and toughness that comes with using the grain side of leather.

Pull-up leather

Pull-up leather is leather that has had additional oil applied during the manufacturing process and is coated with a wax spray coating. This gives the leather a dark, almost greasy appearance and texture, giving it a rough, outdoor appearance.

Pull-Up leather is identical to nubuck and suede in that it is not treated with a protective finish. This style of leather is known for its water resistance and high durability, but it is vulnerable to colour changes in high-wear areas.

When the finish is strained or extended, it lightens, giving it a worn appearance. If you like the worn-in look of a leather accessory, pull up leather is a great option.

Embossed leather

The surface fibre framework of leather can leave an impression when pressed against a hot, raised-patterned metal plate. This is a leather-processing technique that has been used for hundreds of years and offers a wide range of possibilities.

Leathers may be embossed to look like crocodile, turtle, rat, and a variety of other hides. The simpler it is to emboss the leather, the less durable the embossing becomes.

Vegetable-tanned leathers are usually easier to emboss because they hold the effect better than chrome-tanned leathers, which are more elastic. The resulting leathers are usually rigid and solid, with poor breathability. Embossed leathers, on the other hand, may be a less expensive alternative to more difficult-to-work-with animal hides. They also have the added advantage of being exotic without necessitating further, more difficult maintenance.

The thickness of leather is also linked to its softness. The softer the leather, the thinner it is.

Dry milled leather

Leather is loaded into milling drums and rotated to achieve this finish. The leather's natural lines are intensified by the gentle dropping movement, creating a pleasing pebbling effect. It even softens the skin, and it's one of the methods for softening vegetable-tanned leathers. This is a fantastic fabric and upholstery finish.

Antiqued grain

A top coat is spread unevenly or partly discarded to reveal a contrasting underlying paint coat to create two-tone leather. Before applying two pigmented coats, the leather may have been embossed with hollows or creases such that the first layer, normally the darker one, settles into the depressions. This finish gives a sophisticated, aged appearance without the need for a natural patina[65].

Patent leather

Patent leather is traditionally rendered by applying linseed oil-based items to the leather to give it a high gloss finish. A liquid resin coating or a sheet of plastic laminated to the top of modern patent leather. This results in a lovely, gleaming surface with a high-end appearance.

Characteristics of leather

Water resistant

Leather may be designed to absorb, repel, or fully repel water. Most leathers used in the shoe, pocket, upholstery, and leather goods industries have a level of water resistance that allows them to get wet and yet maintain their elasticity and shape after drying. Many leathers used in leather products are handled to prevent spotting from light rain.

Waterproofing is possible for individual applications, such as waterproof shoes and boots that allow you to walk in the rain for many hours without having damp feet. Cattle skins are used to make the majority of waterproof leathers.

Thickness

Skins manufacture thin leathers of exceptional softness that can be used for bookbinding, gloves, padding, and garments. Cow leather can be broken into layers, allowing for a wide range of thicknesses. Leathers may be used for garments, gloves, and other leather products when split thin. Upholstery, car parts, shoes, bags, and leather products are most commonly used medium thickness leathers, while heavy leathers are used for boot soles and crafts.

Softness

The thickness of leather is also linked to its softness. The softer the leather, the thinner it is. However, there are other factors that influence the softness of leather, especially the form of tannage, chrome tanned leather is usually softer, aldehyde tanned leather is less soft, and vegetable tanned leather is firmer. The amount of fatty materials applied to the leather also affects its softness; the more fatty materials added to the leather, the softer it becomes. From a leather glove to a footwear heel, process variations allow us to achieve

a wide variety of softness from the same raw material.

Water absoption and desorption

This is one of leather's distinguishing characteristics, causing it to absorb moisture and then expel it into the air over time. This property gives shoes an exceptional level of comfort that no other substance can match. Perspiration is absorbed onto the fabric from the foot and then evaporates from the shoe's outer surface. The foot remains dry and warm without the cold of swift evaporation or the puddling of drying perspiration because leather can absorb a lot of moisture without getting wet. As a result, the feet do not sweat as much in real leather shoes and boots as they do in plastic and rubber clothing

Water vapor permeability

This property, also known as 'breathability,' enables moisture and air to pass through the leather. This property is especially important for shoe comfort; when the foot sweats, significant quantities of moisture can be generated, which moves through the leather to the outside, making the interior of the shoe drier and more secure with a lower moisture level. Waterproof leathers that are designed to keep you dry and protecting you from the elements would give you an excellent overall result.

Aesthetics and surface pattern

Leather comes in a variety of colours, textures, feels, smells, surface resistance, and handles, making it incredibly special and desirable. Leathers may be as natural as pure vegetable leather or as polished as an automobile seat with exceptional durability.

Heat insulation

Leather's high thermal insulation properties are one of the key reasons why it feels so good on the skin.The rate at which heat travels through a substance is measured by heat insulation. Since leather comprises a huge amount of air (which is a weak conductor of heat), heat moves through the material at a glacial pace.

Malleability

Leather's potential to be moulded into new shapes is another aspect that makes it such a desirable commodity. It can be stiffened or made flexible, and it will maintain its new shape as required. Since both feet are rarely the same size and form, this is critical in footwear. They quickly adjust to suit seamlessly with a little wear.

Results and discussion

Testing of leather

Toxic chemicals known as aromatic amines can be generated when azo colourants are used in the leather dyeing process. The EU and other countries have strict regulations in place for these carcinogens, so leather manufactures must be assured that their products are free of them (Textile testing manual (2011).

Legal limit for chemical properties of leather

The restricted chemicals for leather products are mentioned in Appendix 10 of the EU's REACH regulations. The identification limit for each amine in leather is set at 30 mg/kg in Annex XVII. An Ecolabel can be applied to products that have been tested and found to be within the EU limit of 30 mg/kg. Meanwhile, Chinese regulations set a toxic substance limit of 20 mg/kg[19].

Testing methods

By leather extraction and chemical reaction, two standard chemical tests are used to identify restricted chemicals in leather products:

- Part 1 : Determination of such aromatic amines extracted from azo colourants (EN ISO 17234-1:2010)
- Part 2 : Determination of 4-aminoazobenzene according to EN ISO 17234-2:2011.

Testing leather for pH value

The acidity or alkalinity in leather shows how long the finished product will last. The consistency of the tanning or dyeing operation can also be determined by the pH value. The pH of leather can be determined using one of two ways. The experiments may be carried out in a solution or directly on the material.

Testing methods

The use of damp indicator paper on the product is non-destructive and provides a rough estimate. Cutting the leather and measuring it according to the EN ISO 4045:2008 standard is a more precise process. On a logarithmic scale of 0-14, the pH value was calculated. Actual values will vary from 0 to 14, but the following ranges can be used as a

Table 1 : Quality characterization of leather

Tests	Pigmented leather	Semi-Anline leather	Aniline leather	Nubuck and suede leather
Colour fastness to light	4	4	2/3	4
Colour fastness to rubbing	Dry 3, Wet 2/3	Dry 3, Wet 2/3	Dry 3, Wet 2/3	Dry 3, Wet 2/3
Colour fastness to water spotting	3 (no residual halo)	3 (no residual halo)	3 (no residual halo)	3 (no residual halo)
Colour fastness to water	3	3	3	3
Colour fastness to dry cleaning	3 (no finish loss, no reoiling)	3 (no finish loss, no reoiling)	3 (no finish loss, no reoiling)	3 (no finish loss, no reoiling)
Tear strength	20 N	20 N	20 N	20 N
Water repellency	100	90	80	80

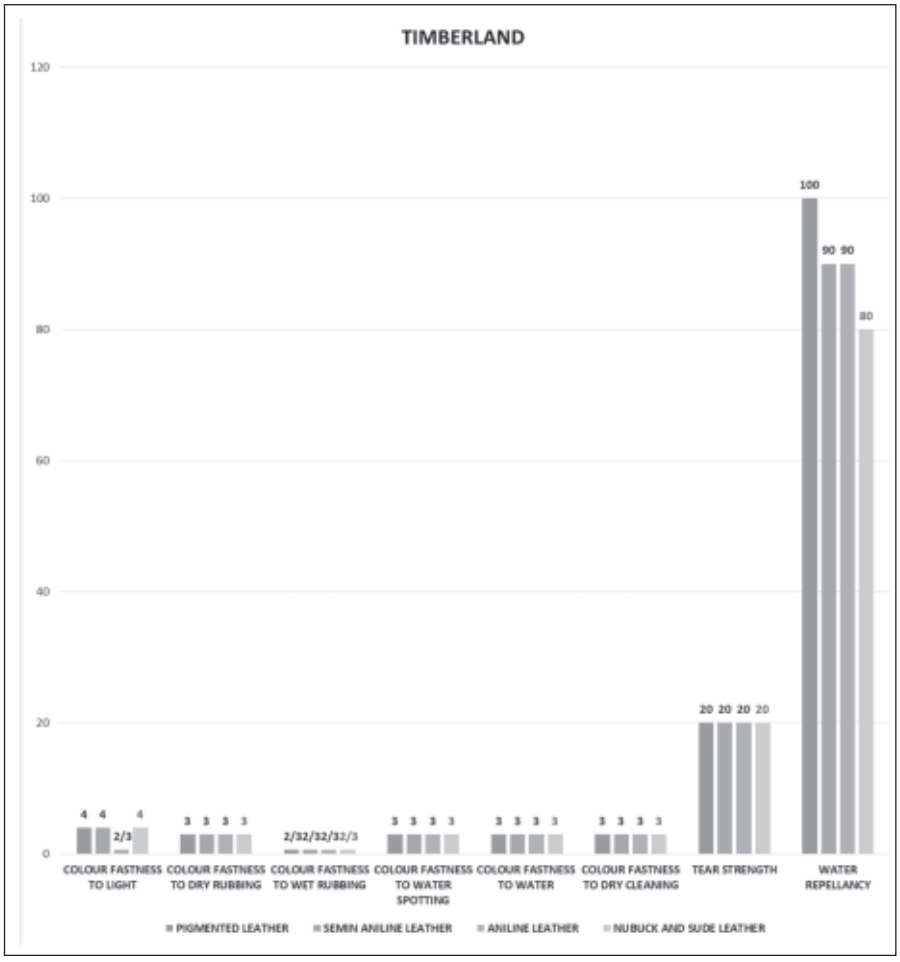

Fig 1 : Comparative analysis of quality characterization of leathers

guide[39].

- pH 1-7 is acidic
- pH 7 neutral
- pH 8-14 is alkaline.

Meaning of test results

Chromium-tanned leather is acidic, with a pH ranging from 3.2 to 5.5, which is natural. Higher levels of acidity, on the other hand, may mean that poor tanning techniques were used, and the leather would decay prematurely. An excessively alkaline result, on the other hand, may mean that dye fixation was done incorrectly, and the leather's colour would fade quickly.

Testing leather for chromium VI compounds

Chromium (VI) is a chemical that is formed during the tanning of leather. Since chromium VI is known to cause extreme allergic reactions when it comes into contact with skin, leather goods sold in the EU must not contain more than 3 mg/kg.

Table 2 : Quality Characterization of leather

Leather & Tests	Thickness	Tongue tear strength ASTM D 4704	Tensile strength ASTM D 2209
Lamb nappa leather	1.0 mm	5 to 6 lbf	20 to 30 lbf
Goat suede leather	0.9 mm	4 to 5 lbf	40 to 50 lbf
Goat suede leather	1.1 mm	6 to 7 lbf	60 to 70 lbf
Lamb nappa leather	0.7 mm	3 to 4 lbf	10 to 20 lbf
Cow nubuck leather	1.3 mm	10 to 15 lbf	70 to 90 lbf

Test methods

Chemical Determination of Chromium (VI) Content in Leather (EN ISO 17075) describes different extraction methods containing chemical solutions that can be used for the experiments. Colorimetric or chromatographic effects are the two types of findings.

Meaning of test results

The presence of chromium(VI) should not be equal to or exceed 3 milligrams per kilogram (0.0003 percent) of the overall dry weight of the leather when the pH is 7.5 - 8.

Physical test for leather

Physical measures that simulate how the final product would be used by the end customer are used to assess the longevity and consistency of leather goods. The following are few examples of experiments performed at QIMA laboratories. These checks are not applicable to wet blue leather.

Wetting resistance (Spray test)

Wetting resistance is a qualitative assessment to test the water repellency of the leather surface or covering.

Adhesive properties of finishing

The ability of fabric to stick to finished leather was checked through this method.

Tear load test

The load required to rip leather through two holes in the test specimen was measured. A double hole tear was often used to assess the stitch tearing resistance of leather.

Tensile Strength test

For production, regulation, specification acceptance, and service assessment of leather, provides a reliable

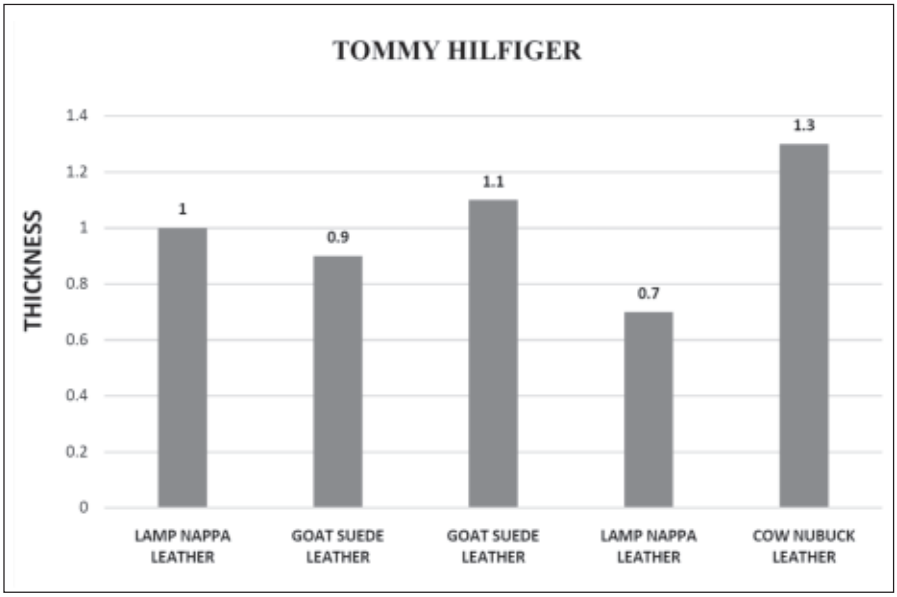

Fig 2 : Comparative analysis of quality characterization of leathers

indicator of the quality of the leather. To measure the load needed to rupture, a 12.7 mm diameter specimen was used.

Colour fastness test

This test specifies, how, well coloured leathers tolerate repeated washing and whether staining of neighboring textile fabrics happens. It is designed primarily for coloured leathers, with or without surface coating.

Relative stiffness test

The relative stiffness of gloving leathers was measured using a torsional apparatus.

Evalution

Testing of leather products determines the quality and the authenticity of the products that are made out of leather. To ensure the quality standards of the leather for its particular use it has to be tested for specific properties. Quality characterization is done to provide the evidence to the customers that the product quality complies with its relevant standards and shows that the product is perfectly fit for its purpose. Good quality satisfies the customer's expectation.

Cow nubuck goat suede

Lamb Nappa

Leathers used in Timberland products

Timberland shoes and boots are mostly made of authentic leather. Timberland is a firm believer in natural leather and full grain because they feel that leather goods can improve with age and last a long time. Pig, horse, horse, and cow hides were also used. They use a number of surface appearances, such as the ones mentioned below.

- Full grain (as it ages it is the best with patina)
- Nubuck is a type of leather that is used (a velvety premium suede look)
- Suede is a kind of suede that is (the bottom layer of the hide which is not as strong)
- Smooth finish with a smooth surface that contributes to the elegance and consistency of the surface.
- Milled leather is top grain leather that has been turned in a milling machine.

Leathers used in Tommy Hilfiger products

Leather products from Tommy Hilfiger tested for its quality characteristics are given below:

- Lamb nappa leather
- Goat suede leather
- Cow nubuck leather.

Conclusion

The quality is one of the most im-

portant characteristics that satisfy the customer's expectations. Here we characterized the quality of the leather from Timberland and Tommy Hilfiger. Different kinds of leather from Timberland such as pigmented leather, aniline leather, semi-aniline leather, nubuck and suede leather were characterised. The tests done for the quality characterization of these leathers were colour fastness, tear strength and water repellency. The pigmented leather has comparatively good water repellency and colour fastness than other leathers. Leather products of Tommy Hilfiger were also characterized for its quality purpose and they are lamb nappa leather, goat suede leather and cow nubuck leather. The tests done for the quality characterization of these leathers were thickness, tongue tear strength ASTM D 4704 and tensile strength ASTM D 2209. The cow nubuck leather has comparatively good quality characteristics like thickness, tongue tear strength and tensile strength than other leathers. Hence, Timberland's pigmented leather and Tommy Hilfiger's cow nubuck leather has good quality parameters that satisfies customer's expectations.

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Textile fabrics for curing of concrete structures

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The increasing demands of absorbent textile fabric in civil and construction help to gain the popularity and water absorbing tendency of the fibres and to reduce the excess use of water for curing the concrete. This can be reduced by using absorbent textile fabric viz. woven, nonwoven and knitted structures for concrete curing for construction of building or any other work. Jute-made gunny bags are mostly preferred for curing of columns, slopes, beams and slabs in civil and constructional engineering[1]. The main aim of placing jute bags is to keep concrete moist and warm to keep it hydrated. The strength of the concrete mostly depends on the curing reaction and curing time of the concrete before a stipulated time. For that it is very necessary there should be a continuous supply of water and even distribution of moisture throughout the curative process. In improper stage of curing it was found that heat generated inside the concrete causes stress and leads in crack formation[2]. The compressive strength of concrete declines with rise in temperature, as the dehydration of water takes place at high temperature and results in reduction in hydration reaction[3]. Period of concrete also plays an important role. At start, concrete strength upsurges with temperature, as huge amount of water is present in concrete[4]. Strength of any concrete material primarily depends upon the strength of cement paste. The strength of cement paste is mainly depends upon the way of mixing and dilution of paste[5,6].

Jute fibre with woven twill structured fabric have been used for the concrete curing application due to its non-compact and open structure.

Fabric structure and absorbency

The structure of fabric has greater effect on absorbency and distribution of the water over the vertical columns and slopes of constrictions. The absorbency of fabric is influenced by the open structure, consisting of type of fibre and fabric manufacturing process. The space rate of fabric in textile weave structure is determined by the ratio of the volume of space to the volume of a fabric. The comparative study of plain weave and twill weave shows, the binding points in twill weave are less than plain weave for the unit area and threads in twill weave are free. Due to this type construction of twill weave sample are large in space and has wide absorption than plain weave. If we increase the space beyond limit then weak link is created between water molecules and water holding capacity decreases when fabric is positioned vertically[7]. It was studied that the extrinsic rate of sorption for jute nonwoven fabric for a particular depth of needle penetration increases initially with increase in density of punch and gradually decreases. This means that the water can easily penetrate when punch density increases resulting in increases of extrinsic rate of sorption initially but the punch density can adversely impact when it goes beyond i.e the fibre damage increases and directly results in loss of ERS. It was seen that the hygroscopic nature of fibre is directly related to polarity of its polymers and the ratio of its amorphous to crystalline region. A hygroscopic polymer consists of large number of polar groups in amorphous polymer. These polar groups attack water molecules, where the amorphous nature

of polymer allows entry of the water molecule into the polymer system[8]. There are two ways of moisture transportation into fabric one by water vapour diffusion and second by wicking action where liquid is transported through capillary transport. This involves the type of material, its surface property of fabric and available area. It was common phenomenon that wicking takes place in wetted fabric. It is determine by the contact angle. It was seen that the wicking usually not happened in synthetic fibre but moisture can transport through it. This kind of concept is mostly preferred for sport textile fabrics manufactured by using polyester fibres. In case,diffusion of water vapour, wicking increases but moisture regain decreases, the reason is that the fibre does not absorb the water[9,10].

Fibre used for civil & construction applications

Preferably natural fibres have been specifically used in civil & construction applications, those fibres are jute, sisal, flax, hemp, ramie and coir. These natural fibres provided high modulus & strength and low breaking extension & elasticity[10].

Advantages of natural fibres

Low cost, strength/durability, availability, robustness, good drapability, biodegradability/environment friendly, but some synthetic fibre are also used for the manufacturing of civil & constructional applications.

Synthetic fibres have the following advantages :

- Most synthetic fibres have good elasticity
- Synthetic fabrics do not wrinkle easily
- Synthetic fabrics are more durable, inexpensive, and more readily available than those made of natural fibres
- Synthetic fibres can handle heavy loads without breaking.

Textile in civil & construction applications

Nowadays textiles is not only used for interior applications like carpets and curtains but also used for civil engineering applications. There are some

Table 1 : Textile fibres used percentagewise for civil applications

Synthetic Fibres	Percentage
Polypropylene	65%
Polyester	30%
Polyamide	1%
Polyethylene	1%
Others	1%

textiles fibres used in cement blocks for permanent applications of houses & civil engineering. There are certain application areas which adds value to the civil & construction by curing the concrete with minimum use of water for increasing the life of the build construction. To fulfil those requirements textiles play a vital role. It can be used for buildtech, geotextile, architectural, green roofs & new development of 3D printer for houses.

The water receptivity of the fabric is an important property which is highly useful for curing of concrete.

Future of synthetic fibres

When looking to the future of textile in civil and construction applications, the role of modified textile fibres is very crucial for enhancing the functionability and providing strength to the concrete. This is not only the single area but also plays vital role in of nanotechnology in the functional enhancement of geotextiles by scaling down the nanoscale reduction in dimension of fibres and increase in surface area mostly effectson the chemical/biological reactivity of polymeric fibres. These fibres will be highly useful for civil applications and they should be advantageous than natural fibres.

Conclusion

Clothing made from textile fibres are not only used for fashion purposes but also for several technical applications. The water receptivity of the fabric is an important property which is highly useful for curing of concrete. There are various textile structures along with the different fibre and manufacturing technologies used in civil and construction applications for increasing the life of concrete structures by minimizing the use of precious water. To explore the potential of textile fibres in relevant application more researches are needed in this field.

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Analysis of thermal comfort properties of soyabean fabric

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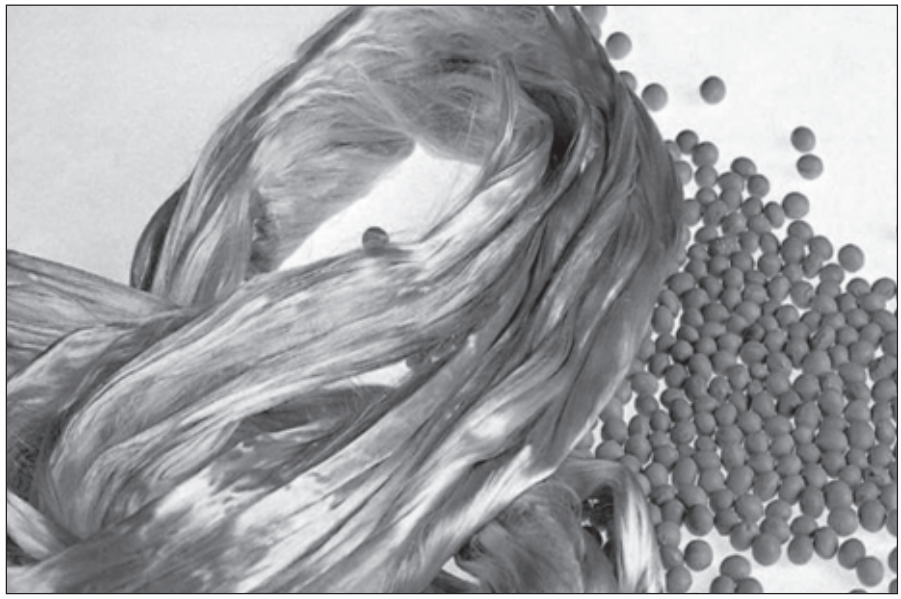
Thermal properties are the important characteristics of textile material related to conductivity of heat. A thermal property includes thermal conductivity, thermal insulation, melting temperature, heat setting and glass transition temperature etc[1]. Thermal comfort properties of fabric depend on fibre, yarn and fabric properties. The type of fibre, yarn count, yarn twist, yarn hairiness, fabric thickness, cover factor, fabric porosity etc. are the important factors which influence comfort properties of fabric[2].

The thermal insulation of textile fabric is due to air contained within the fabric and yams. The fabric thickness is the most important factor governing the thermal insulation of textiles. The thermal insulation of a fabric increases considerably with an increase in the air gap between a hot body and the fabric[3].

Thermal conductivity is the important property of textile material which indicates its ability for heat conduction. The lower thermal conductivity of fabric is obtained from the finer count. The specific conductivity of fabric is dependent on density, thickness and the nature of the constituent fibres[4].



Experimental details

Preparation of fabric samples

In this research work, 100% cotton and soyabean yarns are used for the production of fabric samples, these fabric samples of soyabean and cotton are produced with same specifications such as fabric weight, ends/inch, picks/inch etc. These fabrics were produced on handloom machine with 130 and 150 GSM. These four samples were kept in standard atmosphere for 24 hr. for relaxation and conditioning.

This paper highlights the thermal properties of different woven fabrics produced from cotton and soyabean yarns.

Evaluation of thermal properties of fabric

Thermal comfort properties namely thermal conductivity, thermal insulation and warm/cool sensations by Q-max test method were evaluated for soyabean and cotton fabric samples of 130 and 150 GSM.

Results and discussion

Thermal insulation %

Fig 1 shows the results of thermal insulation % of cotton and soyabean fabric samples. The thermal insulation % of cotton and soyabean fabric samples is 35.27, 32.97, 28.57 and 28.57 respectively. It is observed that the thermal insulation % of cotton fabrics is more than soyabean fabrics. Thermal insulation represents the efficiency of the textile fabric as an insulator.

Thermal conductivity

Fig 2 shows the results of thermal conductivity of cotton and soyabean fabric samples. The cotton fabric samples of 130 and 150 GSM show highest thermal conductivity, whereas soyabean fabric samples of 130 and 150 GSM show lowest thermal conductivity. This may be attributed to characteristics

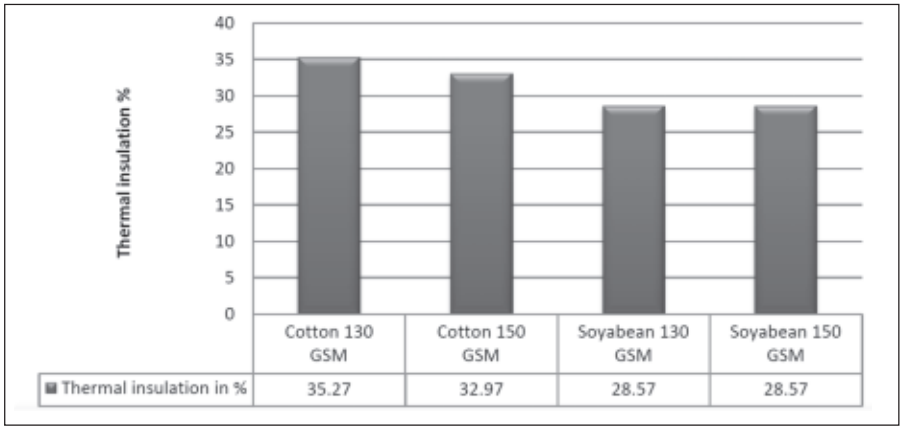


Fig 1 : Thermal Insulation %

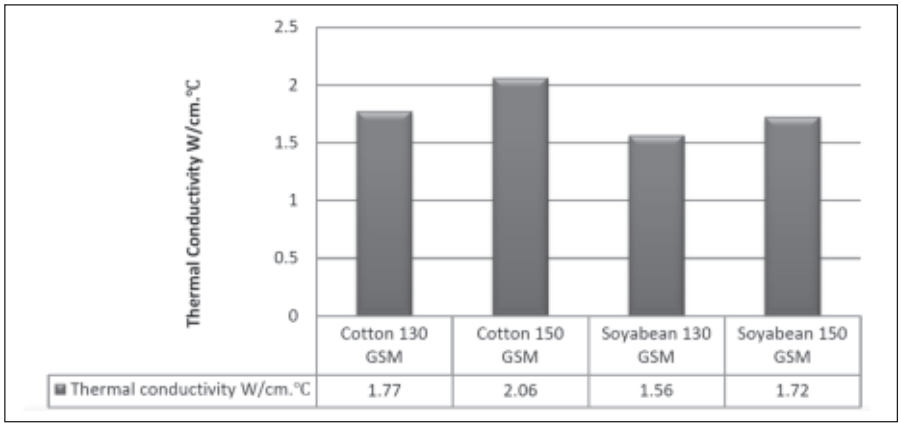


Fig 2 : Thermal conductivity

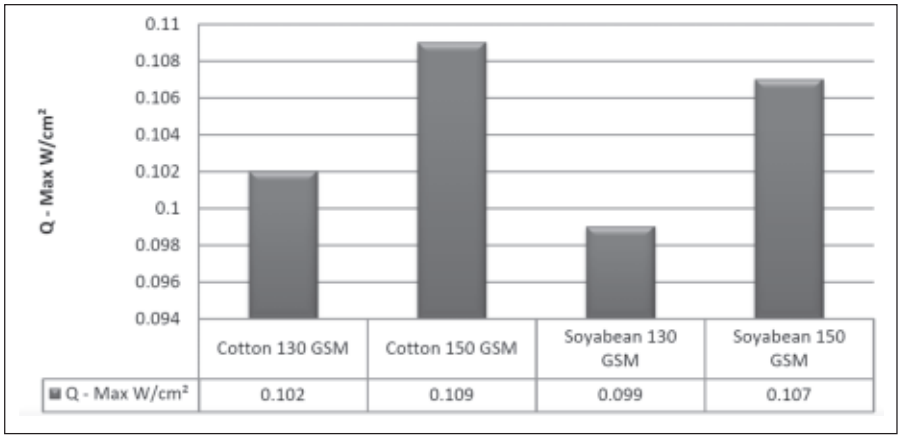


Fig 3 : Q-max test (warm / cool sensations of fabric)

of cotton fibre, which may be a good conductor of warmth and draws heat far away from the skin to allow the body to stay cool, making the weater feel comfortable. Thus, cotton fabrics have higher conductivity than soyabean fabrics.

Q-Max Test (warm / cool sensations of fabric)

Fig 3 illustrates results of Q-max test. The Q-max values of cotton and soyabean fabric samples are 0.102, 0.109, 0.099 and 0.107 respectively. The cotton and soyabean fabric samples of 150 GSM have shown slightly higher values of Q-max W/cm² than its respective fabric samples of 130 GSM. The Q-max value mainly depends on contact area between skin and fabric surface. A maximum value of Q-max denotes a better movement of heat from the body to the surface of cloth leading to cooler feeling.

Conclusion

The evaluation of thermal properties of fabric produced from cotton and soyabean yarns was investigated in this study.

- The cotton fabrics have shown more thermal insulation percentage value than the soyabean fabrics. Thermal insulation represents the efficiency of the textile material as an insulator.
- The value of thermal conductivity of soyabean fabric is less than cotton fabric. Thermal conductivity of fabric is dependent upon the fabric thickness. Thus, the cotton fabrichas shown higher thermal conductivity than soyabean fabric.
- The value of Q-max test of cotton and soyabean fabric sample is almost similar.

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Yarn Expo caters to textile industry's year-round demands

Following the Spring Edition of Yarn Expo which was held from 17-19 March 2021 at the National Exhibition and Convention Center, Shanghai, the next editions' dates have now been revealed. Yarn Expo Autumn will take place at the same venue from 25-27 August 2021, and Yarn Expo Shenzhen will be held at the Shenzhen World Exhibition and Convention Center from 3-5 November 2021. Attracting leading fibre and yarn suppliers as well as quality buyers with the fairs' wide range of products, the three editions of Yarn Expo will cater to the recovering industry by offering a year-round meeting place for the sector to come together to recharge their businesses.

'Amid the pandemic, Yarn Expo was able to re-connect the industry by successfully holding two fairs in Shenzhen and Shanghai in the second half of 2020,' said Ms Wendy Wen, Senior General Manager of Messe Frankfurt (HK) Ltd. 'Yarn Expo Spring 2021 also wrapped up successfully in March, and we look forward to sustaining this momentum with the two editions of Yarn Expo that are scheduled to take place in the second half of 2021. As we witness the continuing market recovery and the return to growth in China, we adjusted our fair calendar by moving the Shenzhen edition from July to November to meet industry demands all year round. This, combined with the physical trade fair and new virtual sourcing experience, ensures Yarn Expo maintains its position as a leading trading platform that supports the industry as the recovery builds momentum.'

Yarn Expo Autumn 2021 will be held concurrently with Intertextile Shanghai Apparel Fabrics - Autumn Edition, Intertextile Shanghai Home Textiles - Autumn Edition, PH Value and CHIC. Covering the entire textile supply chain, the fairs will create synergy and drive these industries' recovery. For buyers who cannot visit the fair in person, Yarn Expo's new AI-driven business matching platform will offer them a virtual sourcing experience by allowing them to search among the fair's diverse range of exhibitors online and schedule meetings with potential suppliers.

Yarn Expo Autumn is organised by Messe Frankfurt (HK) Ltd and the Sub-Council of Textile Industry, CCPIT. Yarn Expo Shenzhen is organised by Messe Frankfurt (HK) Ltd; the Sub-Council of Textile Industry, CCPIT; China Cotton Textile Association; China Chemical Fibers Association; and China Knitting Industrial Association.

IOT (Internet of things) Smart applications in textiles

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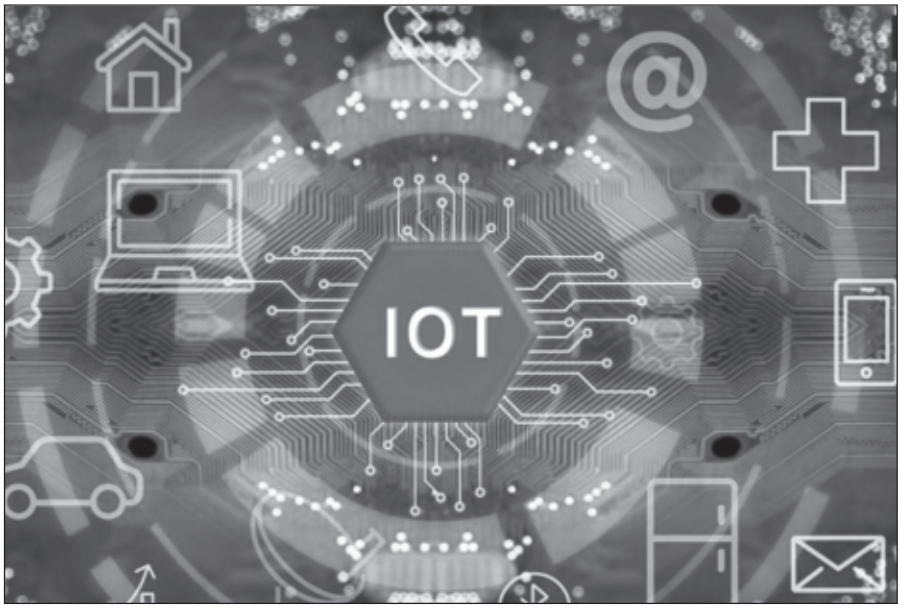

The internet of things or IOT is influencing our lifestyle from the way we react to the way we behave. From air conditioners that you can control with your smartphone to smart cars providing the shortest route or your smartwatch which is tracking your daily activities. IOT is a giant network with connected devices. These devices gather and share data about how they are used and the environment in which they are operated. It is all done using sensors, the sensors are embedded in every physical device. It can be your mobile phone, electrical appliances, Pecos barcode sensors, traffic lights and almost everything that you can come across in day to day life. These sensors continuously emit data about the working state of the devices, but the important question is how do they share this huge amount of data, and how do we put this data to our benefit.

IOT provides a common platform for all these devices to dump their data and the common languages for all the devices to communicate with each other. Data is emitted from various sensors and sent to IOT platform security. It integrates the collected data from various sources further analytics is performed on the data and valuable information is extracted as per requirement. Finally the result is shared with other devices for better user experience, automation and improving the efficiency. In an AC manufacturing industry both the manufacturing machine and the belt have sensors attached. They continuously send data regarding the machine health and the production specific to the manufacturer to identify issues beforehand.

A barcode is attached to each product before leaving the belt. It comprises of product code, manufacturer details, special instructions etc. The manufacturer uses this data to identify where the product was distributed and track the retailer's inventory. Hence the manufacturer can make the product running out of stock available. Next these products are packed and sent to different retailers. Each retailer has a barcode reader to track the products coming from different manufacturers, manage inventory, and also to check the special instructions. The air conditioner has an embedded sensor that emits data regarding its health and temperature. This data is not allied continuously allowing the customer care to contact you for the repair work in time. This is just one of the million scenarios.

Growth of IOT in textile industry

Indian garment industry is one of the biggest investment sectors. There are 20% of woven and 33% of knitted garments produced and exported to other countries every year. There are 60 lakh people working in approximately one lakh units in India. Lots of small sectors

This paper gives an idea on IOT availability in the garment industry and benefits of implementing IOT in the product quality and process sequences to enhance the efficiency level in garment industry.

provide the necessary support to the big industries like buttons, zippers, packing material, buckles etc. Majorly they concentrate on export and it is Limited Liability Company, Private Limited, and Partnership concern. In India, it produces all types of garments like children, men, women, sport etc and it includes shirts, trousers, inners, kinds, pullovers, some accessories like scarves, gloves, shawls, and some attachments of garments. There are more number of retail sectors of garments in both organized and unorganized markets.

Good economy and flexible government policies have supported the economic condition of women and the middle class. The economy rate of the people has increased in the last two decades. The vision and lifestyle of today's people will grow well and they take their culture through wearing garments. They are ready to spend for their interest especially modern trending garments like smart materials and luxury products. It results in the country making lifestyle of rural people good like urban counterparts.

The need of IOT is also necessary in the weaving industry, because weaving process needs frequent monitoring.

In recent days, people have used their income to purchase garments like towels, drapers, curtains etc. The Indian garment industry is observed by many countries in the world such as EU, USA, Canada, Africa, Asia, Russia, Australia and some of countries in east Europe, etc. The garment and clothing agreement terminated on December 2004, this agreement supports the Indian garment industry to a good stage. So the Indian exporters and manufacturers are looking for the creative practices for upgrading their garment quality and cost efficiency than other countries.

Garment industry is a labour dependent industry. There are many advanced technologies and still a lot of manufacturers run their industry in traditional manufacturing processes with smart technology. Some manufactures have different machines and techniques, In the past two decades the garment industry has transformed a lot, with the arrival of IOT and automated machinery it makes the industry less labour dependent. Garment industry requires every single detail of the output in every department. So there is a need on digitization. If it is implemented, it will bring stock management, human resource management, work coordination etc. in every aspect. The main challenge of garment manufacturing is deviation, damage and production delay etc., this can be solved only with IOT technology.

The new culture wants their garment to be of international standard, but the interruptions like intensifying cost of raw material, changing government regulation, cost of operation is increasing day by day, and it puts pressure on the final cost of garments. This condition switches the customer from mass production into small and customized production. IOT gives the idle time of the machine, enhancing equipment productivity, daily target achievement etc. It makes the garments of good quality and so IOT can bring the high business value to the industry.

Bundle system is one of the traditional systems. Machine failure, slow processing, absenteeism, operator independent of final product. Poor quality and less production in the PBS system, difficult to handle the labour, WIP is more in this system. It leads to less number of styles being approached. In every single line of production system, the labour requirement is very important. If one operator fails, the whole line will be affected and the daily target also gets affected. To meet the customer demand and the global competition, unit production system is used. The main disadvantage in this process is monitoring the work flow. In this aspect, training of labour for the particular operation is most important, even though this process is under the non-value added thing, and there is need to take care.

Another big industry in textile field is weaving, it is the fundamental of any woven garments. The need of IOT is also necessary in the weaving industry, because weaving process needs frequent monitoring. A lot of errors can occur and immediate action is necessary to prevent the error otherwise we face big difficulties to sustain the market. The implementation of IOT plays a major role in solving these problems. The introduction of IOT to the industry to overcome the production efficiency and quality of the fabric will increase and also adopting advanced techniques of IOT to monitor the industry status from anywhere.

IOT system in industry

Weaving

There are three main modules :

- Sensor module
- Microcontroller module
- User module.

Sensor Module

- Optical sensor : An optical sensor capable of converting the light rays to electrical signals. It is used to measure

Fig 1 : Optical sensor

the physical quantity of light and transform it into a readable measuring device. To monitor the warping process the optical sensor is used in weaving.

- Proximity sensor : A proximity sensor is to sense the presence of nearby object without any physical contact. The sensor emits a beam of electromagnetic radiation or electromagnetic field and monitors the changes in the field of return signal. Detecting any metal is the use of proximity sensors.
- Reed sensor : It is used to find the

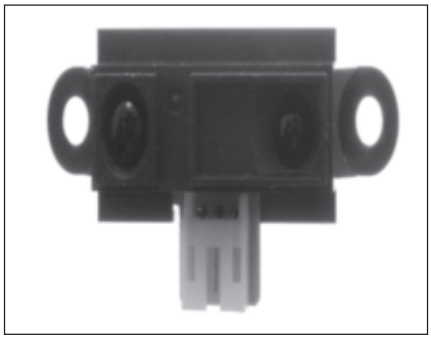

Fig 2 : Proximity sensor

speed of the motor with the help of inert gas called rhodium.

Fig 3 : Reed sensor

- Variable frequency drive (VFD) : It can adjust frequency, it is used to adjust the electromechanical drive system to control the motor speed and torque by changing the input and voltage frequency.
- Relay : Relay is a switch that can operate both electrically and mechanically. It works with the help of electromagnet. It is used in places where only one signal can be used to control a lot of circuits.

Microcontroller module

Raspberry pi 3 is used to transfer data from the loom to the server. It is a

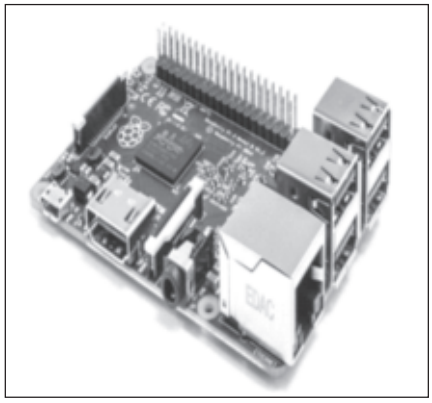

Fig 4 : Microcontroller

series of small single board and speed ranges from 700 MHz to 1.2 GHz and is capable of audio and video output

User Module

The data from the powerloom is transferred from microcontroller to the server. IOT is introduced, users are able

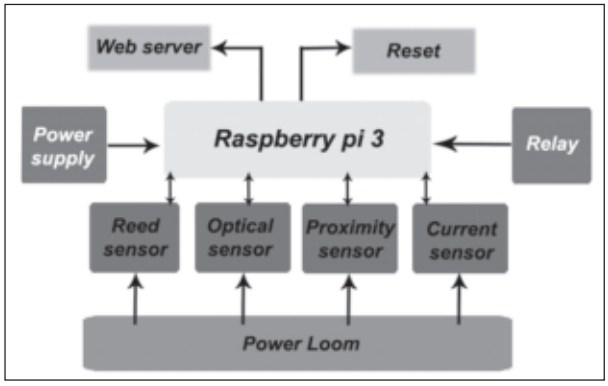

Fig 5 : Block diagram of IOT working method

to monitor the working process via web server in Smartphones, Tabs, PC's etc.

Garment industry

E-clothing

The E-clothing or E-fabric or E-stuffs have different types of sensors fused for specific purposes. There are more number of E-clothing's produced and

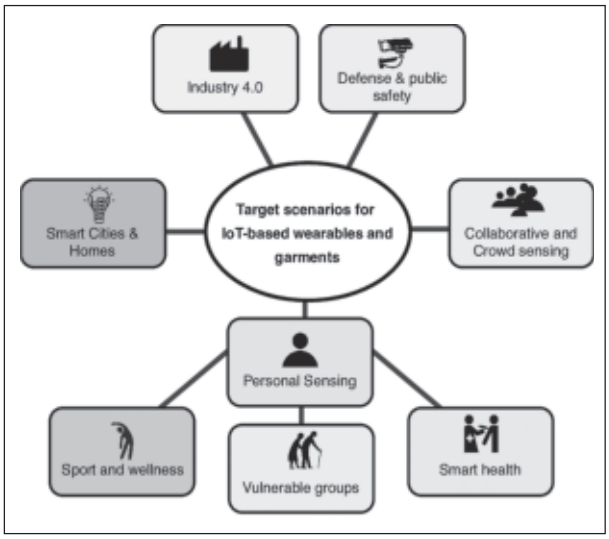

Fig 6 : Purpose of E-clothing

placed in the market for example, an E-cloth design for the senior citizen, the sensor monitors the parameters like blood pressure, insulin level, rate of heart beat etc. These types of garments enhance the industry to goodwill and profitability in the market.

Equipment maintenance

The ecosystem of a factory is monitored continuously. The work performance of the worker will affect the physical environment of a factory. IOT can be very helpful to monitoring and maintaining the parameters of factory.

Maintaining the machines is an important thing. The data of every operating machine like time, machine temperature, air blow speed, RPM, vibration are all documented and analyzed for maintaining the machine idle time. It leads to good operation efficiency and also it reduces the unwanted breakdowns, it is very helpful to avoid the stoppage of machine crucial times.

Embroidery machine

Today's embroidery machines are embedded with PLC systems. Using this system, the data can easily be shared to the various devices. A device which is embedded with IOT it gives data like thread count, output rate, maximum hours worked, stoppages etc. these data is to be visible in PCs, phones, tabs and it gives better management and case to further analysis and communication.

Virtual reality

It is very useful to catch the customer and know things available in the shop. Virtual reality display creates better thought about the shop than the traditional mode of displaying or physical display (manique). It helps the customer meet their choice easily. Many retail shops provide VR to the visitor to see various products available in the shop.

Streamline operations

IOT re-engineers every step in a manufacturing process. It makes the industry maintain production quality and attain optimum production level with reducing the human error. The automated sensor embedded machines with the related software capable of providing

the real time data to monitor the machine performance.

Importance of IOT in garment industry

Inventory management

The major problem of the garment industry is inventory management. The maintenance of the optimum level of storage is very difficult when we meet the demand of the product. IOT can help, the smart moving shelves, sensor for addressing the material, AI picking robots etc. gives the exact status and location of the material. It helps to optimize the inventory. With the help of IOT one reach the customer demand directly without any retail orders.

Process flow efficiency

In any workflow system, some operation or task is time consuming. IOT is capable of giving automation to the floor to reduce the time of finishing the product. Automation helps in every stage of production like reducing labour intensity, reduces error, warehousing, and improves worker conditions. Robots in the process flow can easily guide the flow pieces to the workstation, it reduces the WIP, missing parts, mismatching of parts. It automatically speeds up the process and the cost of the product will be reduced. IOT is also used in communication to the higher authorities. The instruction can easily be passed to everyone and this ability to find the work status is exactly what going on, and everything is recorded and documented.

Product monitoring

IOT can help to track the product location and give the product report such as quality, style, size, manufacturing date, performance, anomalies etc. It will be done using RFID, Wi-Fi and Bluetooth to ensure the product perfection.

Supply chain management

As extreme competition grasps the clothing business, shortening lead times is vital to quick delivery of items. IOT permits producers to coordinate and complete the whole procedure 'In-house' to speed up and inventory network productivity. Via doing errands like materials sourcing, inventive and specialized structure, tests, creation and delivery truly or for all intents and purposes under a similar rooftop, IOT permits producers to run every one of their procedures consistently. The continuous progression of data across divisions guarantees that everybody approaches similar information making greater consistency.

Error management

The whole ecosystem is always engaged with the floor, so receiving the real time data and altering the error instantly. It can save money and eliminate waste. IOT helps to find the errors early by giving notifications to the concern person so it will be fixed fast, it leads to less impact on the product. Real time monitoring gives quick production, clear communication. IOT puts everything in an updated state, Customer looks for customized apparel, IOT gives an opportunity to make it possible to produce to the customer's needs. We need fast real time data of demand. The quick time gives time to think, make changes, review the product, reduce waste, improve quality etc.

The only solution to meet the global demand is by focusing on advanced technologies in industries.

Security and privacy challenges

Video surveillance is an IOT application, and cameras are bundled with many home automation systems. More processing power and higher-bandwidth communications are required for visual sensors. The controversial role of surveillance feels that their privacy has been affected by IOT. Home surveillance may make it easier for pets, small children, and the elders to use the internet, but it also makes it easier to spy on each other, threatening traditional bonds of trust. Most commercial home automation systems offer a cloud component, which helps for external communications, updates, video storage, and increasingly voice response and self-learning analytics. But a cloud connection also increases the power for corporate information harvesting, or black hats gaining access to the cloud platform to steal personal information or attack systems such as security and heating systems. In response to these problems, many open source automation projects promote a localized approach where you control your own cloud, even if it's at the expense of extended functionality.

Privacy and security issues aren't the only problems facing IOT. Even within the home, let alone a factory, the complexity of integration and interoperability can be mind boggling. Standards organizations try to decrease the gaps between different commercial and open source ecosystems, but the gaps between the standards remain. In the open source world, two major players are IOTivity and AllSeen alliance. Technical challenges also remain before IOT gets its true potential. Yet all the key technologies have passed the thresholds required for substantial ROI. Sensors, wireless radios, and processors are getting smaller, cheaper, and more power efficient.

Conclusion

The competition in the garment industry is very high in global market. Manufacturer wants industry in good standard and profitability aspects. So, they have to focus on transformation, in this present situation IOT plays an important role to attain the requirement. Using IOT in critical operations results reducing the time and reach the customer demand fastly, it leads to the industry ahead in the market. Meanwhile customer demands are changing frequently day by day because of trend updates happening in the world. Mainly the small and medium level manufacturers understand the importance of IOT, the companies who understand the need can make their goods as per the required standard and also possible to produce cost effective garments with competitive price. Fashion is naturally transitory, today's trend will fade in a few months or

years. The only solution to meet the global demand is by focusing on advanced technologies in industries to meet the buyer demand and to get sustained in the current situation of market.

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ATJ

Nouryon and Renewcell partner on sustainable textile recycling

Dutch speciality chemicals firm, Nouryon, has signed an agreement with Swedish textile-to-textile recycling firm, Renewcell, to provide speciality chemicals and engineering solutions for its new textile recycling plant in Sundsvall, Sweden. The facility will recycle textile waste, including items such as worn-out jeans and production scraps, to manufacture 60,000 tonnes of Circulose dissolving pulp per year. The facility is the first of its kind in the world and could potentially save hundreds of millions of garments from landfill and incineration each year, contributing to a reduction in greenhouse gas emission from the textile industry. Operations on the facility are scheduled to begin in the first half of 2022. 'Nouryon is thrilled to support novel solutions such as this one, which accelerate the growth of the renewable fibres industry, leverage our essential chemistry and speciality solutions, and underpin our commitment to a sustainable future,' said Mr Antonio Carlos Francisco, Vice President Renewable Fibers at Nouryon.

New sustainable textile fibres, such as Circulose, are a substitute for cotton and non-biodegradable fibres such as polyester. The use of recycled materials in textile manufacturing is expected to play a critical role in reducing the impact of the textile industry on water, land and other natural resources. Mr Patrik Lundström, CEO of Renewcell, said, 'Our mission is to change the global fashion industry. Nouryon is a reliable and well-respected solutions provider to the regenerated fibre industry so we are pleased to partner with them as we embark on this ambitious journey. Nouryon's experience with innovative, sustainable solutions will play a significant role in the long-term success of our mission.'

Application of unconventional textile fibre for agro textiles

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Agro textiles is a leading sector of technical textiles. Currently, utilization of natural unconventional fibre for technical textiles is in demand due to its sustainable nature. These unconventional fibres could be utilized in different areas of technical textiles. The present study was aimed to utilize unconventional nettle (Girardinia diversifolia) fibre as a mulching material. Woven and nonwoven fabric of nettle were developed and utilized for mulching of tomato plants. Nonwoven fabric was observed to be most suitable for tomato plant growth and weed management. Utilization of unconventional fibre for mulch could provide an eco-friendly alternative for weed management and crop management.

Utilization of unconventional fibre for mulch could provide an ecofriendly better alternative for weed management and crop management.

The unconventional fibres may provide an ecofriendly solution in different areas of application. These fibres are generally considered as waste because these are not being utilized for any specific end use due to lack of awareness. Girardinia diversifolia, commonly known as the Himalayan nettle or Nilghiri nettle, is found abundantly in open forest land, river sides and moist habitat in Nepal and in Himalayan parts of India[1]. Girardinia diversifolia belong to Urticaceae family. Himalayan nettle is locally known as allo, shishnu, thulo, potale[2]. Girardinia diversifolia fibre is a bast fibre having 9% of lignin hence it cannot be used for apparel purposes without blending[3]. These locally available fibres have greater potential for agro textiles where these can be used in its pure form without any blending.

Agriculture as a leading industry of India provides employment opportunities to majority of population[4]. Therefore, Agrotextile is a critical and promising sector amid all the other sectors of technical textiles. Agro textiles is a part of technical textiles which generally serves all areas of agriculture such as horticulture, vegetable science, fisheries and animal husbandry[5]. Various textile-based products such as sunscreen, bird net, windshield, mulch mat, hail protection net, harvesting net, etc. are serving purpose of above-mentioned allied areas of agriculture[6]. The importance of agro-textiles can be affirmed significantly all over the world but few applications such as mulching have shown more encouraging and direct impacts on growth and production of various crops and vegetables[7]. Mulching as a part of agro-textiles is the process of layering the soil to make more healthy conditions for the growth of plant. Mulching provide many benefits to the plant such as it helps to maintain the soil moisture, suppresses weed, creates microclimate near plant root zone to protect the plant root from cold weather conditions. It also provides

a barrier to soil pathogens and helps to reduce soil erosion. Organic mulch materials provide nutrients to the soil after they decompose[8]. Conventionally, natural mulch such as leaf, straw, dead leaves were used for covering the soil[9]. Presently various synthetic fibres such as polyethylene and polypropylene sheets are extensively used due to their high strength, durability and other properties which makes them suitable for agricultural applications[10]. But nowadays, the demand for organic and sustainable agriculture practices is on rise to keep in harmony with the environment. Sustainable agriculture is the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of environment and conserving natural resources. Utilization of natural fibres for agro textiles pave a way for sustainable agriculture as it provides various favorable conditions to agricultural crops and at the same time it is biodegradable in nature which degrades after some years and acts as natural fertilizer[11]. The main objective of the present study was to utilize Girardinia diversifolia fibre as mulch which not only serve the purpose of mulching but also help to utilize a locally available fibre for promoting the sustainable agriculture practices. Not only can nettle fibre production help India contribute to long-term textile development, but it can also help the rural hill population generate income and provide a steady source of income. Natural fibres seem to have become an obvious option for enlightened textile producers and consumers as the value and popularity of concepts such as green, eco-friendly, and sustainability has grown.

Material and methods

The Girardinia diversifolia ribbons were used in the study. Fibre were extracted from these ribbons and converted into yarn through hand spinning on Bageshwari charkha. Woven fabric was prepared from the hand spun yarn. Nonwoven fabric was prepared directly from carded fibres using needle punching technique. Developed woven and nonwoven fabrics of pure nettle fibres were used as mulching material. The field experiment of mulching was conducted on the tomato plant in the premises of Home Science College, G B Pant University of Agriculture & Technology, Pantnagar. Experiment was done to test the effects of conventional mulch material i.e. organic material (straw) and synthetic material (polythene) as well as prepared woven and nonwoven fabrics on the growth parameters of the tomato plant.

Fabrics and polythene of size 105x11 inch was cut and laid on the experimental field. The pure woven fabric made from nettle fibre was loosely woven and had an open weave structure. Therefore, natural guar gum (Cyamopsis tetragonolobus) coating was applied on the fabric to close the pores, so that the fabric could be used for mulching. For the preparation of the natural gum, thin paste was prepared by adding 1.5 g guar gum powder in the 100 ml of lukewarm water. This mixture was stirred continuously to make even paste. Thin paste of guar gum was applied twice on to the woven fabrics with the help of small squeeze. Then after the application of the resin, the woven fabric samples were dried under the sun for one hour.

The main objective of the present study was to utilize Girardinia diversifolia fibre as mulch for promoting the sustainable agriculture practices.

The experiment of mulching was started in the month of October with 31.80ºC average temperature and 92 per cent relative humidity. The plot area of 9x10 feet was taken for mulching experiment. Raised beds were prepared for plantation of tomato plants and plot was irrigated. Five treatments were planned for execution with six tomato plants in each keeping a distance of 10 to 15 cm between two plants. The duration of mulchingexperiment was kept ninety days. The treatments which were planned in the experiment are shown in *Table 1*.

Table 1 : Treatments for mulching of tomato plant

Treatments	Particulars
T_1	Woven nettle fabric
T_2	Nonwoven nettle fabric
T_3	Synthetic material (Black Polythene) as mulch material
T_4	Organic material (Straw) as mulch material
T_5	Without mulch material (Control Sample)

Observation parameters for suitability assessment of mulch material

First observation was taken on the first day of the plantation and other observations were recorded after fifteen days interval, in this way total six observations were recorded for all treatments. Thus, mulching experiment was carried out for 90 days. The following parameters were observed to evaluate the suitability of different fabrics/materials for mulching.

Soil temperature

The temperature of the soil was calculated with the help of soil thermometer by inserting the thermometer 5-inches to 6-inches deep in the soil. A screwdriver was used to make a pilot hole in the soil. Thermometer was inserted into the pilot hole, shade was provided if the sun was bright. This was achieved by simply putting the hand between the sun and the thermometer. This ensured that the reading was accurate. Readings were taken in the morning and late afternoon, and then average was taken.

Moisture percentage of soil

Moisture percent of soil samples was calculated by the gravimetric method. In this method, the soil samples were taken in the pre-weighed moisture boxes and immediately covered with the lid. These moisture boxes were then weighed on the

physical balance with lid removed. The readings were taken in grams, upto two decimal places. The samples were then dried in hot air oven at 105°C for about 48 hours. The dried soil samples were then again weighed in grams and the moisture per cent (Pw) was calculated as follows (Mishra and Ahmed, 1990):

$$\text{Moisture percent (Pw)} = \frac{WS_1 - WS_2}{WS_1} \times 100$$

where,

WS_1 = Original weight of soil

WS_2 = Dry weight of soil

Growth attributes of plant

- Plant height : The height of the plant was measured with the help of the scale in inches from the ground level to the top of the plant.
- No of Branches : The no. of branches of each plant in each treatment of plant was counted and noted down.
- Number of leaves : In each treatment, number of leaves in each branch of plant was counted and noted down.
- Weed count : Weeds were removed before the preparation of the plot area for the experiment. First reading of weed count was taken in fresh condition, when the seeds were turned into seedlings. Reading was noted down and then the weeds were removed. Reading of weed count was taken after fifteen days again and weeds were removed. The same process was repeated for each observation.
- First flower initiation : In each treatment, time of first flower initiation was recorded. After that number of flowers after every 15 days was also recorded.

Table 2 : Plant growth parameters on plantation day

Sample	Leaves (no.)	Plant height (cm)	Longest leave (cm)	Branches (no.)	Soil morning (°C)	Soil afternoon (°C)	Soil moisture (°C)
T_1	12	10.12	2.12	2	18	20	26
T_2	13	11.12	1.90	3			
T_3	13	12.12	1.89	3			
T_4	14	12.32	1.89	2			
T_5	12	112.09	1.67	1			

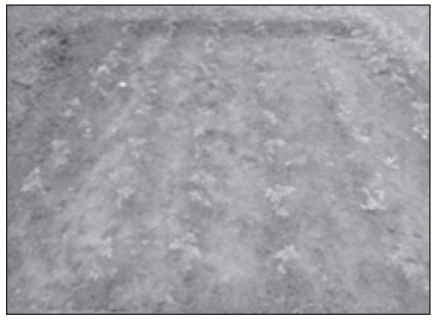


Fig 1 : Tomato plants after plantation

Fig 2 : Tomato plants after installation of mulch

- Number of fruits : Number of fruits in each treatment was counted and noted.

Results

Total 6 readings were taken during 90 days experiment, but for comparison purpose first and last reading has been presented here.

Plant growth parameters on plantation day

All the tomato plants were selected purposively to avoid the biasness in the results. Plants were of almost similar height and having almost same number of leaves and branches. It is evident from *Table 2* that on plantation day, tomato plants had 12-14 leaves and 2 to 3 branches whereas height of plants varied from 10.12 cm to 12.32 cm. Recorded soil temperature was 18°C in morning and 20°C in afternoon and calculated moisture percent was 20. After plantation, plants were irrigated then different mulch material viz. T_1, T_2, T_3 and T_4 were installed. One row with six tomato plants was left as control.

Plant growth parameters after 15 days of plantation

All the observations were again

Table 3 : Plant growth parameters after 15 days of plantation with different mulching treatments

Sample	Leaves (no.)	Plant height (cm)	Longest leave (cm)	Branches (no.)	First Flower initiation day	Flowers (no.)	Soil temp. morning (°C)	Soil temp. afternoon (°C)	Soil moisture (%)
T_1	36	23	4.5	5	7th	1	17	20	36
T_2	37	23.25	4	5	5th	1	15	18	34
T_3	32	19.33	3.75	6	5th	1	16	18	35
T_4	37	23.9	4.25	6	4th	2	17	19	35
T_5	32	20.66	3.91	5	3rd	3	18	21	34
CD (5%)	2.3	1.3	0.6	0.9	0.8	0.6	0.8	1.2	1.4
CV	3.7	3.3	8.7	9.9	9.3	22.8	2.7	3.5	2.3

T_1 : Woven mulch T_2 : Nonwoven T_3 : Polythene mulch T_4 : Dried grass mulch T_5 : Control

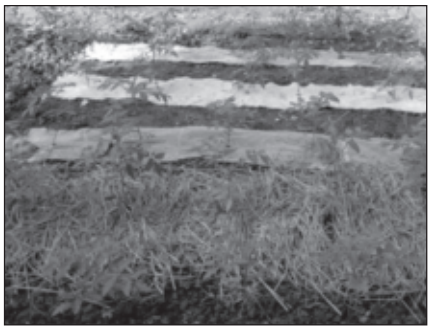


Fig 3 : Tomato plants after 15 days of plantation

recorded after fifteen days *(Table 3)*. It is clear from *Table 3* that all the growth parameters doubled in number after 15 days. Number of leaves was found highest (37) for T_4 and T_2 treatment which was followed by T_1 treatment and found to be 36. Although difference in number of leaves of T_1, T_2 and T_4 treatment was not significant. Least number of leaves (32) was observed for T_3 and T_5 treatment. Observed plant height was 23.90 cm for T_4. This was almost similar to the values of T_1 and T_2 treatment *(Table 3)*. Least plant growth was observed for T_3 (19.33 cm). Longest leaf (4.5 cm) was found in case of T_1 treatment. Calculated number of branches were 6 for T_3 and T_4 treatment where as number of branches was 5 for all other treatments. While observing the first flower initiation day it was found that samples without any treatment has shown first flower on the third day and T_1 treatment has shown first flower on the 7th day. Soil temperature in case of without mulch area was observed to be 18 and 21 degree centigrade respectively in morning and afternoon time while the soil temperature under mulch material was almost nearby highest (18) for control sample which raised to 21 degree centigrade in afternoon. It is clear from the *Table 3* that highest value of percent moisture (36) was found for T_1 treatment.

Statistical analysis showed that significant difference was observed in plant height, number of leaves, first flower initiation and number of flowers of the nonwoven fabric treatment and without mulch treatment. This clearly indicates that nonwoven fabric as mulch material had positive impact on growth parameters of tomato plants.

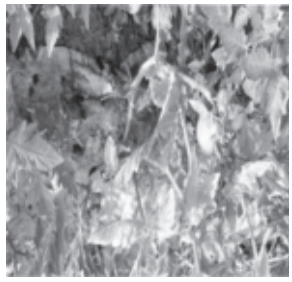
Table 4 : Plant growth parameters after 90 days of plantation with different mulching treatment

Sample	Leaves (no.)	Plant height (cm)	Longest leave (cm)	Branches (no.)	No. of fruit	Flowers (no.)	Weeds (no.)	Soil temp. morning (°C)	Soil temp. afternoon (°C)	Soil moisture (%)
T_1	380	42	12.4	40	20	10	15	14	15	34.09
T_2	402	56	12	39	22	16	16	12	15	27.07
T_3	313	43	11	30	19	9	11	11	13	32.09
T_4	320	44	11.3	29	14	10	10	10	14	25.65
T_5	288	46	11.7	30	11	5	28	10	13	27.89
CD (%)	2.5	1.6	0.7	1.4	1.5	1.4	1.4	1.1	1.4	2.5
CV	2.8	1.9	3.4	2.2	5.0	7.7	4.6	5.3	5.3	4.8

T_1 : Woven mulch T_2 : Nonwoven T_3 : Polythene mulch T_4 : Dried grass mulch T_5 : Control

4a : Woven mulch

4b : Nonwoven mulch



4c : Polythene mulch

4d : Dried grass mulch

4e : Control (wihout mulch)

Fig 4 : Tomato plants after 90 days of plantation

Plant growth parameters after 90 days of plantation

After completion of three months, it was observed that tomato plants were still growing in terms of number of leaves, plant height and number of branches *(Table 4)*. Although the rate of growth in plant parameters slowed down. On 90th day there was increase in number of fruits and flowers in all the treatments. Analysis of *Table 4* showed that T_2 (Nonwoven nettle fabric) mulch treatment showed highest number of leaves (402) and had maximum plant height (56 cm). T_1 (Woven nettle fabric) treatment has shown maximum number of branches (40) and T_2(Nonwoven nettle fabric) had 39 branches. It was seen that T_4 (dried grass straw mulch) had only 29 branches. As far as

number of fruits was concerned for all the treatments, it was found that T_2 (Nonwoven nettle fabric) treatment had highest number of fruits (22) and only 9 fruits were observed for control sample. T_2 (Nonwoven nettle fabric) treatment showed maximum number of flowers (17) followed by T_1 (Woven nettle fabric) treatment which has shown 10 flowers. Highest weed count i.e. 28 was recorded for control samples and weed count was lowest (10) for T_4(Organic material) treatment. Recorded value of soil temperature was 10°C in morning, which was lowest whereas it increased to 14°C in afternoon for T_4 (Organic material) treatment. Moisture percentage was highest (34.09) for the plants with T_2 (Nonwoven nettle fabric) treatment.

Statistical analysis revealed that the differences in plant height and longest leave of nonwoven and organic mulch material (straw) was observed to be non-significant. It can be concluded from this analysis that the nonwoven fabric provided similar results as that of organic mulch material in terms of crop growth. Hence it can be recommended as an option for mulch material. While significant difference was observed in case of number of fruits in woven and nonwoven fabric treatments with number of fruits in without mulch treatment.

Conclusion

Nonwoven mulch fabric of Girardinia diversifolia fibre showed better results in terms of various growth parameter of tomato plants as compared to other mulch material such as polythene and woven fabric. Nonwoven mulch of Girardinia diversifolia fabric material could be recommended for further use on the basis of its positive impact on agricultural crop such as it enhanced the fruit growth. It is renewable and durable. Nonwoven fabric made of Girardinia diversifolia is is an eco-friendly alternative for agro textiles. Thus development of agro textiles by using Girardinia diversifolia fibre can be an opportunity in terms of wild fibre utilization as well as sustainable livelihood.

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ATJ

BASF joins digital watermark

BASF has joined 'HolyGrail 2.0 - Digital watermarks for accurate sorting and high-quality recycling' as a member. The initiative aims to increase plastic recycling rates by adding imperceptible digital watermarks to product packaging.

Under the auspices of AIM, the European Brands Association, BASF and more than 120 companies and organisations from the packaging value chain have joined forces in the initiative to prove the viability of digital watermarking technologies for accurate sorting and the business case at large scale.

'The plastics used for packaging are extremely valuable materials to protect goods and reduce food waste. When plastics are sorted properly, we can offer a suitable additive package to return them to high-performance applications. Thus, we are excited to support HolyGrail 2.0 in their search for optimised and circular plastic packaging,' said Dr Achim Sties, Senior Vice President, Performance Chemicals Europe, BASF. Ineffective sorting is one of the fundamental barriers to wider recycling of lightweight packaging waste and thus in achieving a circular economy for packaging. The better the sorting and identification of packaging, the more efficient the mechanical recycling process and the better the quality of recyclates.

The discovery of digital watermarking was made under the New Plastics Economy programme of the Ellen MacArthur Foundation, which investigated different innovations to improve post-consumer recycling. Digital water-marks were found to be the most promising technology.

Devan Chemicals expands into bio-based textile finish

Devan Chemicals, headquartered in Ronse, Belgium, has expanded its bio-based textile finish range with the addition of two new products: a softener and a quick-dry finish, both produced from vegetable oils and in line with the company's current bio-based chemistry developments.

According to the business, the Covid-19 pandemic is acting as a catalyst for a global green economy, due to both shifting consumer behavior and political intervention. As a result, the textile industry is constantly looking for more sustainable and products fit for circular programs.

Devan introduced its first bio-based manufacturing in 2019 and is dedicated to developing bio-based iterations of its current textile finishes.

CEO at Devan, Sven Ghyselinck, said they are on a quest to be able to further expand their Bio-Based spectrum. They needed to have a bigger effect on circularity than they had before, so they looked at what fabric producers use a lot - softeners and moisture control systems.

He added that they will only help the market have a greater effect on sustainability by spending more on large-volume goods. They are excited to launch their new natural Passerelle series, which follows the success of their natural antimicrobial Bi-Ome NTL.

Passerelle Soft NTL is a vegetable-based, long-lasting softness technology. The technology is washable and suitable for natural fibers such as hemp and cotton, as well as synthetic fibers such as recycled polyester. As per ASTM D6866-20 standard, the technology has a bio content of more than 85%.

Passerelle Quick-Dry NTL is a moisture control technology that is also based on vegetable materials. This bio-based finish has a high wicking and evaporation potential, making it easier and quicker to evaporate water and sweat. According to OECD 301B, the technology is more than 60% biodegradable after 28 days. Devan has all of these brands in stock and ready to ship.

Under the SceNTL brand name, the firm has introduced Bio-flam, a bio-based flame retardant, bio-based PCMs, Bi-Ome NTL, a natural antimicrobial, and plant-based fragrances since 2019.

www.devan.net

Single fiber applicator for glass fiber

WH Lipex part of Woollard & Henry Group and a fiberglass technology company, introduces the single fiber applicator, a coating module that enables manufacturers to apply sizing to individual glass fiber strands.

Fibers are no longer in bundles, but are instead individually displayed, ensuring all individual filaments are better enclosed with wetting additive. This performance is said to significantly increase the sizing amount on the fibers, improving their bonding capabilities.

Further, WH Lipex said the applicator's main advantages include increasing the end-product's mechanical properties, thus offering new possibilities for weight and cost reduction.

www.lipex.de

BAAM printer demonstrates 3D printing with recycled composites

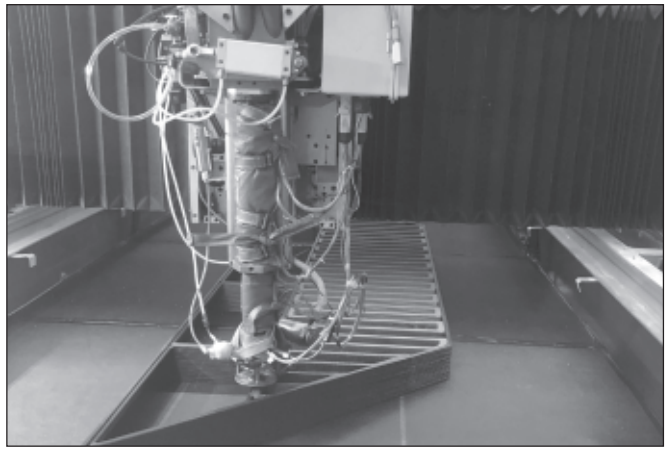
Cincinnati Inc. announced that it has used its Big Area Additive Manufacturing (BAAM) machine to demonstrate that recycled materials can be used for 3D printing by producing what the company says is one of the largest monolithic multi-material objects to date. The demonstration successfully proved that large-scale multi-material printing can be done effectively and economically with recycled composite materials.

The large-scale multi-material print was achieved by making modifications to the BAAM and including a new extruder design that accommodates a dual feed system.

For the past several years, CI has collaborated with the U.S. Department of Energy's (DOE) Oak Ridge National Laboratory to continuously improve and develop the BAAM. Initial research focused on large-scale printing of single material systems, typically short fiber-reinforced polymers.

'The objective of this particular study was to demonstrate printing of a multi-material composites tool including transitions, exceeding 10 feet in length, containing recycled material and printed without manual intervention,' says Alex Riestenberg, CI's Additive Manufacturing product manager.

The part selected for this demonstration was a single facet of a precast concrete tool used in the production of commercial window panels for a high-rise development in New York City. The mold weighed approximately 400 pounds, with a length of 10 feet, 10 inches. Print time was approximately seven hours.



BAAM multi-material extrusion system (Photo : Cincinnati Inc.)

Neenah Filtration launches NeenahPure

Neenah Filtration has launched NeenahPure, - a HVAC filter media solution for clean air. HVAC and Air Purifier filters play a key role in providing clean indoor air with a high-quality filter media essential for the effectiveness of a filter element.

Neenah Filtration filter media portfolio NeenahPure covers efficiencies from ePM10 50% to ePM1 80% (ISO 16890) and M5-F9 (EN779:2012). The highly charged materials reach

efficiencies > 99.9% (KCL, 0,3 µm, 5.3 cm/s). NeenahPure filter media are available for pleatable and bag filter elements.

As well as the standard portfolio, the company also provides tailor-made solutions to satisfy individual requirements in regards to performance and runability. Neenah offers high precision slitting according to its customers' specifications (combination of different widths, narrow widths etc.), online inspection systems, high flexibility in the composition of media, and different bonding technologies.

NeenahPure media also avoids harmful fiber sheddings, has a very high dust holding capacity (DHC), a good pressure loss and efficiency ratio, a very high mechanical stability, and flame retardancy.

'Studies have shown that by using multiple materials within a structure, new mechanical responses and multi-functionality can be achieved - such as lightweight structures with tailored mechanical properties, soft and rigid segments within a part and impact resistant structures,' said ORNL materials scientist Vidya Kishore.

The two materials used in the build were a blend containing 100% recycled CF/ABS and standard CF/ABS and ABS Syntactic foam.

Besides the ecological benefits of using recycled materials, Cincinnati Inc. said the advantages of multi-material extrusion include incorporating conductive circuit printing for smart structures, lightweight core structures, lower costs for tooling, easier removal of support material, localized reinforcement of specific areas, the capability to use different materials in different features on the component and even changing the color of the part.'

www.e-ci.com

E-LOOP products with recycled content

ELIX Polymers, a global leader in specialised styrene-based thermoplastics, has included all of its Circular Economy activities under the new brand name, E-LOOP, which was launched successfully last February. The E-LOOP brand includes two strategic programmes of ELIX Sustainable Portfolio Solutions: Circular Plastics and Responsible Innovation.

In October 2020, ELIX obtained the ISCC Plus certification for its production facility in Tarragona, Spain. ISCC (International Sustainability & Carbon Certification) is a globally applicable sustainability certification system that covers all sustainable feedstocks, including circular and bio-based materials and renewables.

The first products are already commercially available, and the first volumes of E-LOOP H801 MR black and M220 CR25 have been produced and validated by customers from the automotive and toy industries, which have shown an interest in implementing these more sustainable solutions as a part of their own Circular Economy strategies to achieve their sustainability goals. E-LOOP H801 MR is a product that contains mechanically recycled material, and E-LOOP M220 CR25 is a product that contains sustainable feedstocks certified under ISCC Plus. ELIX receives these recycled feedstocks from its established suppliers as a result of close cooperation based on long-term agreements.

www.elix-polymers.com

Plus X honours for Confitex

Confitex, the developer of plastic-free absorbent and leakproof textiles based in Auckland, New Zealand, was recognised both for its technology and Just'nCase brand of reusable nursing pads at the 2021 Plux X Awards.

Plus X is the world's largest innovation awards programme for technology, sports and lifestyle brands and previous winners include Apple, Adidas, Audi, BMW, Lexus, Mercedes-Benz, Microsoft, Miele, Nike, Nespresso, Nikon and Weber.

The Confitex patented textile is highly absorbent, durable and odour-resistant when used in the company's ranges of absorbent underwear for men and women and therefore also provides convenience, comfort and performance in the Just'nCase nursing pads for breastfeeding mothers. These can be easily slipped inside a maternity bra and can be worn day and night, held securely in place by the silicone grip matrix on the exterior

Just'nCase nursing pads for breastfeeding mothers can be easily slipped inside a maternity bra and worn day and night

As well as winning coveted 'bests' for its technology and brand, Confitex received an impressive six out of seven possible seals for innovation, high quality, ease of use, functionality, ergonomics and ecology in the health and personal care category.

Confitex founder and design director Frantisek Riha-Scott said the awards were a testament to the commitment of his company to creating the most high-performing textile technology in the leakproof absorbent apparel industry.

'Rather than settle for the old-fashioned method of leakproofing with a layer of PU plastic, which remains the industry standard for the vast majority of brands, we have invented and patented the only fully waterproof fabric for reusable innerwear products that doesn't contain PU plastic,' he said. 'As well as the obvious environmental advantages, not using PU plastic also provides practical benefits, in that we can mould and heat-seal our designs without distorting the textile, and stitch through the waterproof layer without causing leaks - allowing for a far wider range of design options as well as superior leakproof performance. For our customers, another benefit is that they can launder our products in the washing machine and tumble dryer, whereas the layer of PU plastic in other brands tends to distort when tumble dried, leading to unwanted leakage.'

www.confitex.com

Recycled technical fibres for car tyres

Leading tyre producer Michelin has successfully tested and applied the enzymatic recycling process for PET polyester waste of Carbios to create a high tenacity fibre that meets its technical requirements.

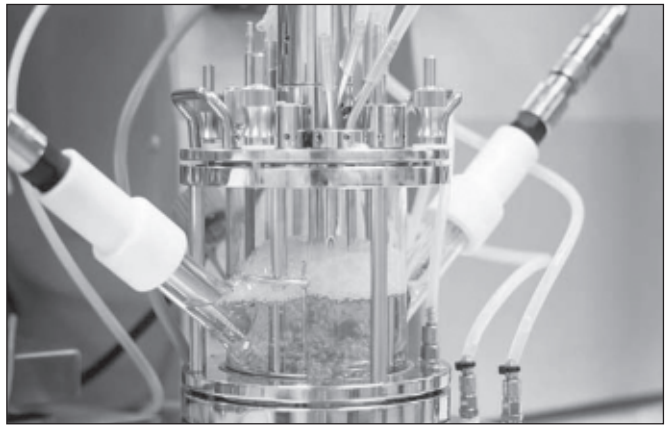
The enzymatic recycling process of Carbios, based in Clermont-Ferrand, France, uses an enzyme capable of depolymerizing the PET contained in various plastics or textiles - bottles, trays, polyester clothing etc. - and allows the infinite recycling of all types of PET waste. It also allows the production of 100% recycled and recyclable PET products, with the same quality as virgin PET.

Conventional thermomechanical recycling processes for complex plastics do not achieve the high-performance PET grade required for pneumatic applications. However, the monomers resulting from the Carbios process, which uses coloured and opaque plastic waste such as bottles, once repolymerized as PET, make it possible to obtain a high-tenacity fibre, meeting Michelin's requirements.

The technical fibre obtained is processed with the same prototype installations. This high tenacity polyester is particularly suitable for tyres, due to its breakage resistance, toughness, and thermal stability.

'We are very proud to be the first to have produced and tested recycled technical fibres for tyres,' said Nicolas Seeboth, director of polymer research at Michelin. 'These high-tech reinforcements have demonstrated their ability to provide performance identical to those from the oil industry.'

The Carbios enzymatic recycling process therefore enables Michelin to get one step closer to its sustainable ambitions, and contributes to the entry of tyres into a truly circular economy. Michelin is committed to achieving 40% sustainable materials (of renewable or recycled origin) by 2030 and 100% by 2050.



The Carbios process uses an enzyme capable of depolymerizing the PET contained in various plastics or textiles

Every year, 1.6 billion car tyres are sold worldwide and the PET fibres used in them is around 800,000 tons.

When applied to Michelin, this represents nearly 3 billion plastic bottles per year that could be recycled into technical fibres for use in the company's tyres.

www.carbios.com

Solvay introduces sustainable Amodel® Bios PPA

Solvay has extended its diversified portfolio of high-performance polyphthalamide (PPA) compounds with Amodel® Bios, a new family of partially bio-based long-chain PPA products particularly indicated for demanding electrical and electronic applications in e-mobility. Besides its renewable feedstock content from non-food competing sources, it is produced with 100% renewable electricity, minimizing its global warming potential (GWP) well below the level of other bio-based PPA.

Backed by a long history of pioneering PPA innovations, Solvay's Amodel® Bios PPA combines this exceptional sustainability with outstanding performance properties for components in e-motors, power electronics and other high-end electrical systems. Most notably, it offers the highest glass transition temperature (Tg 135°C) of all bio-based PPA in the market and a melting point (Tm) of 315°C. Designed for injection molding, it is an ideal candidate for non-blistering reflow soldered surface mount devices (SMD) and parts in the cooling circuit of power electronics, including fluid connectors.

In addition, the limited moisture absorption of the new polymer versus standard PPA results in a high level of dimensional stability at a low risk of stress corrosion, which is particularly important with regard to miniaturized electrical connectors. Amodel® Bios PPA also provides superior impact strength even in halogen-free flame-retarded grades complying with UL94 V0, and is well-suited for colorable applications. This is complemented by high elongation, weld-line strength and excellent surface aesthetics.

'As we continue driving the innovation of PPA to meet the higher performance needs in e-mobility, the introduction of Amodel® Bios PPA also demonstrates Solvay's commitment to help customers achieve ambitious sustainability targets, which aligns with our One Planet message,' states Brian Baleno, Head of Marketing - Transportation at Solvay Specialty Polymers.

Backpacks with Polygiene Stays Fresh technology

US brand Gregory, one of the most iconic names in the outdoor industry, has launched this Spring 2021, two new backpacks featuring Polygiene Stays Fresh® technology from the Swedish firm. The Kalmia and Katmai are both designed for trekking and are set to be in high demand as many partsof the world open up following the lifting of Covid restrictions.

Both backpacks feature Gregory's ventilated FreeFloat 360 suspension system, which is engineered for stable, responsive support. Polygiene Stays Fresh technology is applied to the mesh that covers the entire suspension and is formulated to last for years of demanding use on the trail.

The validation of Polygiene came initially from Gregory's extensive testing process and in-which all packs are sent to their headquarters for a post-mortem review, as Gregory Product Line Manager, Matt Connors explains below.

'Our testers will use these packs for weeks and months on places like the AT (Appalachian Trail) where the packs are constantly inundated with sweat and bacteria from the wearers body. By the time they get to us, they smell awful. It turns out that sweat odor is a chief complaint amongst ourtesters and for some, becomes reason enough to not want to wear the pack.'

Connors continues, 'It became clear that Polygiene had a commitment to science and helping us understand efficacy. What really impressed us was the data on safety, resource use, and potential benefits toward extending the life of the product.'

Gregory, who has a strong commitment to sustainability, opted to use Polygiene Stays Fresh technology to help extend the life of their products. The technology works by inhibiting the growth of odor-causing bacteria and stops the odor at the source, permanently. Therefore, as in the case for the Gregory testers, prevents a product from being prematurely discarded because it smells.

As well as allowing wearers to use the Kalmia (available in a women's specific ft 50L or 60L) or the Katmai (available in a men's specific fit 55L or 65L) for a greater length of time, the treatment also means the backpacks are more likely to be sold on into the thriving second hand market, helping keepthe products alive even longer.

Polygiene's commercial director for the West Cost, Bobby Howell adds, 'We couldn't be more excited to be partnering with one, if not the leader in performance backpacks and feel strongly the extended life potential of these backpacks is crucial and a key USP for the end-consumer.'

https://polygiene.com

Amodel® Bios PPA is globally launched and initially available in four grades differentiated by custom-tailored property profiles for structural, electrification and flame-retardant applications. Amodel® is a registered trademark of Solvay.

www.solvay.com

FSC certification for Pirelli

Pirelli has introduced the world's first tyre which has both its rubber and viscose certified by the Forest Stewardship Council (FSC). The new Pirelli P Zero tyre will first be used on the latest BMW X5 plug-in hybrid model.

Natural rubber is a basic material for many everyday products, such as rubber boots or mattresses and about six million smallholders worldwide are responsible for 80% of its production. They operate small farms of one or two hectares in size and under a wide variety of conditions in the so-called 'rubber belt' in tropical regions.

Addressing the social, environmental and economic needs of these millions of smallholder farms is a major challenge. The implementation of FSC certification for natural rubber plantations, forests and chain of custody contributes to resolving this by supporting responsible and sustainable natural rubber production.

FSC has already made considerable progress in certifying the natural rubber value chain for various consumer sectors. A variety of products are available on the market today that contain certified natural rubber, including gloves, footwear, mattresses, pillows and yoga mats.

FSC certification gives an assurance that natural rubber and viscose in these products is sourced from forests or plantations with safe working conditions, and without deforestation or other environmental damage.

The tyre sector consumes roughly 70% of natural rubber production with the potential to play a crucial role in sustainable sourcing but this is the very first FSC certification in the sector.

www.pirelli.com

Hengst develops pre-filter for extraction systems

Hengst Filtration, in partnership with German extraction systems' specialist, TBH, has developed the InLine patient filter, a pre-filter for extraction systems to protect patients and staff in dental, medical and aesthetic settings.

The pre-filter was developed by Hengst Filtration and the development of the housing was a joint effort between Hengst and TBH. All extraction systems sold by TBH GmbH as part of its DF-series will now be equipped with the InLine patient filter.

Operating as a pre-filter in the capture element, it is located in the extraction hood close to the patient and captures emerging particles and aerosols, reliably separating them. The low price per unit allows for a filter change after each application, ensuring every patient's safety. The front filtration also keeps the users safe by waring off biofilms and refluxes from the extraction arm.

Offering a filter area of 0.145 m^2, it is possible to clean even high flow volumes at a rate of up to 120 m^3 per hour. Filter efficiency according to ISO16890 is rated at ePM10, with a separation degree of more than 65%.

www.hengst.com ATJ

Internationally distinguished textile magazines

Asian Textile Journal (ATJ) has long been established as the leading international textile magazine for businesses involved in the textile manufacturing industry from fibres to spinning and weaving, knitting, chemical processing to finished garments, nonwovens, composites, environmental aspects etc. It provides expert comments and analyses on general industry trends, corporate business profiles, technological developments and innovations.

With the Asian textile and apparel industry on the growth path, there are enormous opportunities and challenges for textile industry to capture new markets, and the **Asian Textile Journal (ATJ)** launched in 1992 as a monthly magazine - understands the needs of the industry and is the right medium to implement your business strategies in emerging textile sectors of Asia, Europe, North America, and MENA (Middle East and North Africa) regions.

Asian Textile Journal (ATJ) with a readership of 70,000 plus in 35 countries offers to its advertisers the most effective and right medium for advertising.

Speciality and industrial fabrics serve an array of markets, everything from awnings to auto airbags. Automotive textiles represent the most valuable world market for industrial textiles. Medical textiles are one of the most important, continually expanding field in technical textiles.

Asian Technical Textiles (ATT) - a quarterly magazine published since 2007 - is for technical textiles and nonwovens sector which is circulated in Asia, MENA (Middle East and North Africa) countries, Europe, USA and Canada. It offers unrivalled coverage of ever-expanding uses of engineered polymer/fibres from the vast consumer hygiene markets to automotive, medical, protective, filtration, geotextiles, agrotextiles, acoustics etc.

Since the nonwovens and technical textiles industry has international presence, the ATT having a circulation of 6,000 copies with a readership of 60,000 plus enables advertisers to reach major markets in more than 40 countries.

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