Meryl Fabrics. TECHNOLOGICAL ADVANCEMENT.

Director of Innovation

The summary of the technological innovation and advancements that the company has achieved during our development period:

Meryl Fabrics initially targeted the medical material sector with its development but expanded into the development of the available fabrics. We created an incredibly versatile product with properties displayed in our fibres never previously made. We aimed to supply these unique and innovatively designed materials to existing manufacturers or provide finished items with the highest quality.

During the long development period, over six exciting years, the Meryl Fabrics team worked to develop a fully reusable, environmentally friendly fabric with built-in antimicrobial protection. The available range of materials we have created has exceptional touch-increased durability and can retain an enhanced anti-viral property after consistent wear and washing. As the company specialises in producing goods for the textiles manufacturing industry, its competent professionals sought to ensure the fabric is safe and comfortable by developing enhanced material properties such as tensile strength comfort and lightweight for the benefit of end-users.

The company sought to produce the first commercially available fabric blend used in an antimicrobial fabric capable of withstanding multiple wash cycles whilst retaining end-user comfort. The company developed and made its durable fabric high-quality and has now further improved material properties for enhanced comfort. The company undertook significant fabric development prototypes and iterations to achieve Meryl's compleat circular solution.

The company undertook significant development of the fabric to integrate the antimicrobial properties directly into the fibre itself instead of coating the material, which would render it more difficult to recycle and susceptible to breakdown in washing cycles. The company achieved this by integrating silver Ion[1] and vesicle technologies[2], which are 99.997% effective against most types of envelope viruses like SARS-COV-2 viruses and produced a 'z weave' of the fabric to retain both user comfort and antimicrobial efficacies of over 99%.

During this period, by further developing our manufacturing process, Meryl Fabrics' innovation can now withstand increased wash cycles and ensure that the antimicrobial properties remain unchanged. The R&D process undertaken by the team altered the method by which we integrated silver Ions into the fabric. Previously, we used a 'wet' method for application by dipping the cloth in a silver ion solution during manufacturing. Through a process development, we now apply the silver Ions through a 'dry' method, where silver Ions in the dry form are added to the raw material in the extrusion vat—allowing for the integration of the silver ions at the base level.
We tested the fabric through hundreds of machine wash cycles at varying temperatures and redeveloped it to ensure durability. The company developed and experimented with multiple weave structures to ensure robustness through machine washing. In doing so, we determined a novel 'z-type' weave was most suitable for fabric durability and protectiveness.

The clothing industry has significantly contributed staple fibres into garments when mixed with other fibres to simulate the high-quality touch consumers expect.
Unfortunately, these staple fibres release microfibres from the fabrics during their wear and significantly more during washing, polluting water courses, rivers, oceans, and sometimes entering the food chain. The team further altered their previous manufacturing process to ensure Meryl fabrics are microplastic pollution free.

All yarns avoid microfibre pollution through design. The team has created a high-quality molecular structure by adding hydrogen gas to the extrusion process. The unit can deliver high performance and exceptional touch to our yarns and fabrics by combining cross sections and molecular manipulations with tenacities and different yarn deniers. Strong molecular Hydrogen chains avoid the release of microfibers into the air and water.

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[1] Silver ions are incorporated into fabric for antimicrobial properties. Silver ions are positively charged particles, whereas viral proteins are negatively charged by nature. The silver ions thus attract the negative viral particles and destroy the virus.
[2] Vesicle technology accelerates the silver ion viral denaturing process by depleting the viral membrane surrounding viral proteins, allowing the silver ions to quickly penetrate the core of the viral protein load and effectively denature viruses.

The team at Meryl Fabrics have strived to formulate a sustainable, safe, and innovative brand with products that will revolutionise the use and disposal of textiles. The company is engaged to further develop and design products with varying iterations by changing the design and manufacturing process.

The R&D team has worked to create products around the industry's environmental impact, quality, and protection, built around a circular economy[3].

A vital requirement of the design strategy was adapting to the environmental impact of a reusable range of fabrics, which is the most exciting aspect we have created. When considering the massive reduction of water usage and reduced use of solvents and chemicals during production, with the added benefit, the fabric has zero microfibres shedding through manufacture, use, and washing, which is a significant achievement. We are working to eradicate all production waste at the manufacturing stages by returning weaving and cutting waste to the manufacturing plant for reuse in new yarns, which can be as high as 22%. The team also developed an innovative sustainable waterless dyeing process called Meryl Ecodye.
The colour is added during the yarn extrusion process in this new and novel process, eliminating the traditional dyeing step of fabrics and garments. Meryl Ecodye allows for a high-quality colour with excellent fastness properties, greater absorption, and a softer touch, making the process environmentally friendly. The Meryl Eco dye process development allowed for the application of colour alongside the treatments during the yarn spinning, reducing chemicals and solvents typically used in dyeing the fabric. It allowed the Meryl Eco dye process to minimise water waste further. This process has saved millions of litres of fresh water customarily used in fabric dying and reduced pollution released into the environment.

The team undertook a detailed study to enable the complete control and traceability of their materials and product, as the engineers and logistics experts monitor all aspects of production. As the production facilities work to the detailed operation plans, Meryl Fabrics has accountability and monitoring with an entire audit trail. The circular economic implications constitute a significant step forward in recycling. It allows for the reusability of all products at the end of their extended operational life and enables the return of identical replacements.
The team moving forward, continue to reduce its carbon footprint by manufacturing all products within Europe to minimise the impact of transportation. In conclusion, as they bring their product to the end user, we all benefit from what Meryl has created, the business, because they reduce their impact on the planet by consuming and buying less, and they save money, helping everyone.
Educating the market and the public to benefit from a complete circular process enables the significant reduction of the environmental impact of textile waste on the planet. The benefit to the end customers is simple; they remove the cost of disposing of their used textiles by returning them for reuse. These products have significantly increased their operational life and, alongside washing at considerably lower temperatures, reduced energy usage.

The R&D team faced numerous scientific and technological uncertainties in further developing its antimicrobial fabric blend. The company tackled these uncertainties created due to the multiple changes it made in its processes to improve its fabrics. The need to ensure the new fabric possesses enhanced properties while still being effective against viral loads, fully recyclable, machine washable and still comfortable for the end users via enhancement of tensile strength material properties.
To resolve the apparent system uncertainties, the company launched numerous development iterations of its fabric to ensure the blend would minimise the use of Elastin for recyclability and maximise the use of Polyamide 6-6 (Nylon); whilst incorporating the silver Ion and vesicle technologies for antimicrobial properties. Additionally, the company had to ensure the fabric weave remained soft and pliable to fit ergonomically for any textile applications.

The company faced more uncertainty in changing the application of the silver Ion to the dry method; we had to undertake numerous fabric iterations in terms of weave type, materials used, antimicrobial technologies leveraged and overall wash resistance. We launched these iterations over several months to ensure the fabric met our recyclability and safety regulations. Initially, the produced material could withstand over 100 wash cycles; additional product iterations were to determine a method to improve resistance and durability following washing to increase the machine wash resistance to more cycles.

[3] A circular economy is a systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the 'take-make-waste' linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources.

The resolution of uncertainties could be achieved through investigation and experimentation. Furthermore, revolutionary product creation requires knowledge and solutions to resolve the scientific or technological uncertainties not readily deducible to the company's competent professionals. This gap was significant to bridge due to the high level of technical complexity and various influencing factors that needed to be balanced.

Project Objectives:

The scientific/technological advancements that our company sought to achieve during this development period are summarised below:

Meryl Fabrics has targeted the textile sector with its development. The fabrics developed and created are incredibly versatile, with properties displayed in the garments they have previously made. We set out to supply our unique and innovatively designed materials to existing manufacturers or provide finished items with the highest quality. We are working to eradicate all production waste at the manufacturing stages by returning weaving and cutting waste to the manufacturing plant for reuse in new yarns, which can be as high as 22%. The team also developed an innovative sustainable waterless dyeing process called Meryl Ecodye. The colour is added during the yarn extrusion process in this new and novel process, eliminating the traditional dyeing step of fabrics and garments. Meryl Ecodye allows for a high-quality colour with excellent fastness properties, greater absorption, and a softer touch, making the process environmentally friendly. The Meryl Eco dye development provides for the application of colour alongside the treatments during the yarn spinning, reducing chemicals and solvents typically used in the original dyeing of the fabric. It allowed the Meryl Eco dye process to minimise water waste further. This process has saved Billions of litres of fresh drinking water and reduced the tonnes of pollutants released into the environment during traditional textile production. Our circular solution reduces CO2 emissions by an average of 30 tons per ton produced.

Scientific or Technological Advancement Sought:

The scientific/technological advancements that the company has achieved are summarised below.

- ⇒ Further Developments of an innovative methodology to produce this eco-friendly fibre, creating a complete circular solution and reducing our environmental impact, continues.
- ⇒ Finding solutions to improve performance, environmental protection, and cost reduction will drive our work.

During the last 12 months, Meryl Fabrics worked to further the development of their fully recyclable innovative yarn and fabrics with zero microplastic pollution. The R&D team have developed a Fabric weave capable of retaining an enhanced anti-viral property after consistent wear and washing (we created anti-viral benefits of the fabric alongside a partner company).

The company is now directly producing products for the consumer market, as some manufacturers are unwilling to change how they have always done things. We are committed to moving forward to ensure the development of our enhanced materials delivery to the market.

We will also stay consistent with critical properties such as tensile strength and guaranteed material precision, even following multiple washes.

Durability significantly improves high-use operational areas such as hotels, cruise lines, and health and care facilities. Where the average linen bed sheet faces material degradation following 100 washes, the company developed and produced this durable fabric lasting over three times longer and has further improved material properties for enhanced comfort. The company continues to make significant fabric development prototypes and iterations.

The clothing industry is a massive contributor of staple fibres into garments when combined with other fibres consisting of silicon to simulate the high-quality touch consumers require. These types of fibres shed microplastics released from the garments during washes and, as a result, pollute oceans and the linked water systems. The R&D team at Meryl Fabrics have altered their manufacturing process several times to ensure all yarns avoid microfibre pollution. We control these microfibres through our innovative procedure of hydrogen bonding; no other textile company in the world do this process to the knowledge of the Meryl Fabrics professionals. Following vertical micro extrusion, we achieve hydrogen bonding by bombarding the fibre thread with hydrogen gas.

The hydrogen gas bombards the polymer in a molten state to seal the filaments and fibre to create a twofold effect, bind to produce yarn, and further strengthen the bonds.
The bonding treatment prevents dissipation; the R&D team, inspired by plasma gas treatment, commence trials and testing for hydrogen bombarding. By introducing this procedure into their process, we were able to further our pursuit of ensuring material longevity and tackling fibre degradation.

Further, the Meryl Fabrics team trialled and tested the effects of denier manipulation and filament count, altering how to build the hydrogen bridges. Resulting in no micro fibre shredding; the only company in the world to do something like this. Trying to imagine a way of bond treatments to prevent dissipation was creating heat to reduce excess; the idea came from a plasma gas treatment. It is a friction component, as when you pass hydrogen gas over a surface, you create a heat bond. The garments designed for Air Canada showed real-world examples of the effects demonstrated in their material through their innovative methods.

The development team altered the construction of the material through dernier manipulation and filament count. Using a 2-ply yarn of 44[4]/46[5] creates an 88/92 count. The structure of this material gives a double benefit of no absorbance of oil and fuels and being heat resistant.

The Meryl Fabrics competent professionals are thus able to create a high-quality molecular structure. The combination of cross-sections creates molecular manipulations with tenacity and varying yarn dernier. The team create a high-performance material with strong molecular hydrogens chains that ensure no micro fibre shedding into air and water and maintain an exceptional touch for the user. The team at Meryl Fabrics have further strived to formulate a sustainable, safe, and innovative brand to revolutionise textiles' use, disposal and overall life cycle. The company have engaged to further develop and design products with varying iterations made by changing the design and manufacturing process. A vital requirement of the design strategy was adapting to the environmental impact of a reusable range of fabrics, which is the most exciting aspect we have created. When considering the massive reduction of water usage and reduced use of solvents and chemicals during production, with the added benefit, the fabric has zero microfibres shedding through manufacture, use, and washing, which is a significant achievement.
Further to the development and production of our material, the Meryl Fabrics team have created and designed an infrastructure to ensure an infinite life cycle for their fabric. The infrastructure created by the company allows for old garments made by Meryl Fabrics that have completed their extended working life and returned to Meryl for reuse; the material can be shredded and remade into yarns and fabrics, then returned as garments and reused. Following the two shredding processes, the Meryl Fabrics' infrastructure returns the garments to the base material (polyamide chips). The chips then make new fibres and yarns (100% reusable, total infinite cycle) through this system six times with guaranteed material precision and tensile strength.

The Meryl Fabrics team performed testing procedures to test the tensile strength and gauge filaments to ensure continuous gauge quality and regularly submitted samples for testing and other certification.

The team conducted studies to enable the control and traceability of their material and products. Our engineers and logistics experts monitor all aspects of the production; the facilities work to the detailed operation place to ensure a complete audit trail. Creating a circular solution constitutes a significant step forward in recycling. The team moving forward, continue to reduce its carbon footprint by manufacturing all products within Europe to minimise the impact of transportation. In conclusion, as they bring their product to the marketplace and educate the public to benefit from a complete circular process, they significantly reduce the environmental impact of textile waste on the planet. The benefit to our customers is simple; they remove the cost of disposing of their used textiles by returning them for reuse. These products significantly increased their operational life during washing at considerably lower temperatures, reducing energy usage. Resolution of these uncertainties could only be achieved through systematic investigation and experimentation. The knowledge and solutions required to resolve the scientific or technological uncertainties were not readily deducible to the company's competent professionals due to the high level of technical complexity and various influencing factors that needed to be balanced, representing a significant knowledge gap to bridge.

[4] Dernier Circumference
[5] Filament Count