

RCO100: Developing improved 100% recycled cotton yarns a range of fabric applications

The over consumption in the textile and apparel sectors carries a significant burden on our ecosystem. In order to help facilitate a greener future across both sectors, we have established R&D projects such as our recycling facility, making RCO100 yarns and fabrics to offer very important solutions in response to improving material use and decreasing material waste.

Textile waste for recycling is separated into two categories: industry-generated and consumer-generated. Textile wastes created by the industry before the consumer consist of fibre, yarn, fabric and clothing from production processes. The Global Recycled Standard (GRS) defines the amount of waste generated during the production of a garment before it reaches the consumer as “pre-consumer” and the textile waste after use by the consumer as “post-consumer”.

During a conventional recycling process, the short fibre content increases during the process, due to fabric and fibres are severely damaged in the mechanical shredding and opening. A conventional recycling process also reduces the strength values of the fibre compared to its virgin cotton state. For this reason, conventionally recycled fibres in the market are blended with virgin cottons or other fibres like polyester or viscose. This is done to improve yarn quality and running performance using conventional rotor and ring spinning methods.

By working together, with our project, we have developed a mechanical recycling and complementary spinning technology to produce 100% pre-consumer recycled cotton yarns, which achieve quality levels similar to virgin ring carded cotton yarns. Especially in weaving preparation, warping and sizing, the exposure of the warp yarns to tension requires high and consistent tensile strength. Conventional recycled yarns have 30-35% lower tensile strength compared to virgin cotton, due to the high percentage of short fibres after the aggressive mechanical opening processes involved. Our gentle RCO100 mechanical recycling process in combination with a specifically developed compact ring spinning system, allows us to produce 100% recycled cotton yarns with parameters close to virgin cotton yarn qualities. This achievement opened the doors to a wider market use of 100% recycled cotton yarns in segments like shirting, denim and knits.

Within the scope of the collaborative project, it is our aim to further develop finer, consistent, yarns with lower hairiness. It includes modifications in the spinning process from card to winder.

A key component is our mechanical compact system, with its modified spinning geometry, which has been especially adapted for the shorter recycled fibres.

With these improvements thanks to RCO100 yarn, 100% recycled denim, knits and shirting fabrics have been developed in different structures catering to a range of brands and companies across several markets.

RCO100 yarns close to virgin cotton quality were produced and the effect of our recycling in the textile sector has since expanded.

- **Which aspects of textile manufacturing does the achievement focus on?**

The consumption of textile products continues to increase day by day with population growth and rapid change in fashion. However, the natural resources are, unfortunately, decreasing at the same time. For a sustainable future it is important to increase the use of textile products produced from recycling. This project is about the development of innovative methods in mechanical recycling and ring spinning to increase the use of 100% recycled cotton yarns, produced from recycling in textiles. Thanks to our developed 100% recycled cotton yarns, it is possible to increase the use of recycled cotton in warp, weft and knitted textile fabrics.

- **Which challenges were taken on, what was the pursued aim?**

A few years back we started to develop 100% recycled cotton yarns based on the open end spinning process. These OE yarns can achieve decent quality in coarser yarn counts. Due to lower yarn strengths of these 100% recycled yarns they were used for weaving with reduced process speeds in weaving preparation and weaving itself. Here an improved, gentle mechanical recycling process helped to improve yarn strengths and therefore speeds in the weaving process could be readjusted to virgin cotton yarn levels.

The higher short fibre content limits the yarn quality and the production of finer yarns counts in OE and conventional ring spinning. The lower strength, higher hairiness and unevenness of the yarn also causes lower quality in the finer count ranges.

Through improvements in the mechanical recycling process we achieved longer staple length and stronger fibres.

By using a mechanical compacting system we were able to control the short fibers in the drafting system and the use of specific condensers as well as cots allows us to reduce the short fibres in compact ring spinning. This helps to improve yarn quality, strength and reduces hairiness of these yarns.

- **Which was the methodical approach? Is the achievement related to a process or product? What were the key steps to success?**

The combination of a gentle fibre treatment in the recycling line plus the innovative mechanical compact yarn system was used to achieve best possible results with 100% recycled cotton. This was a key factor to succeed with these 100% recycled cotton yarns. Higher tensile strength and improved IPI values in compact spinning allows the industrial production of yarns in the range of

Ne7/1 to Ne30/1, consisting of 100% recycled cotton. These yarns can be used in warp and weft for ring denim as well as for shirting fabrics. It is also possible to produce compact core yarns made from 100% recycled cotton. We use a recycled elastane mono yarn to maintain our 100% recycled yarn status.

- **Quantify the benefit of your approach leading to the achievement.**

Yarns for weaving production, especially in the warp, must have a certain strength, elongation and low hairiness. If tensile strength values are low, it is not possible for the yarns to work in warping and weaving. Fabrics cannot be produced at efficient production levels due to high yarn breakage rates. In these studies, the mechanical recycling system in combination with the compact ring spinning system provided yarns in the range of Ne7/1, Ne12/1, Ne20/1, Ne24/1 and Ne30/1 for denim and shirting productions. The core yarns enlarged the fabric range, specially in denim. All these fabrics achieve similar physical test performances as virgin carded cotton fabrics.

- **Describe how your experience will promote further advances in your respective field or beyond.**

Thanks to these possibilities with recycled cotton in the textile sector, the use of pesticides, fertilisers and water, which still needs to be used in the virgin cotton production, will be reduced. Using recycling processes the cultivated land can be used for food agricultural products. With our recycling technology, the secondary uses in the cotton life cycle will also be increased. With the effective use of natural resources for a sustainable future, the waste loads in the textile industry will be reduced and their effects on environmental pollution will also be reduced.

Biography

For years, Kipas and Sântis Textiles have worked together closely to actively improve the textiles industry, one metre at a time. Built on generations of textile expertise with sustainable production engrained in the DNA of each company, both companies strive to inspire real change and collaboration for the future of our textile industry through sustainable innovation and production.

Kipaş Mensucat İşletmeleri A.Ş.

Kipaş Mensucat İşletmeleri A.Ş. is the largest integrated company in Turkey and Europe engaged in textile production. Weaving is a part of the company where innovative applications on recycling is used in our open-end and ring yarn production. At Kipaş, the vision is to lead the change towards circular and renewable sectors while being a fair and reliable company.

Our priority is to respect nature and people. We accept the needs of current and future generations and the demands of both our planet and our industry. We believe that the way we run our business should be economically, socially and environmentally sustainable. We aim to move forward with sustainable investments and to adopt globally innovative technologies for long-term business opportunities in order to keep Kipaş Holding afloat in a rapidly changing world.

Kipaş Tekstil established the R&D Center in 2013 in order to develop innovative technologies and direct the textile industry to further change. The R&D Center collaborates with national and international universities and leading suppliers and customers around the world. Making a total of 31 applications to the Turkish Patent Institute as of 2021, Kipaş Textiles registered 8 of these applications and adopted the principle of protecting its original and innovative ideas.

Kipaş has many national successes within the scope of efficiency projects. Some of these are listed below.

Productivity projects Awards

1st place: “Zero water in Denim Indigo Dyeing Project”

3rd Place: “Water Recyling in Dyeing and Finishing Departments Project”

Säntis Textiles Pte Ltd

Säntis Textiles is a Swiss, family-run textile technology and sourcing company specialised in developing innovative recycled textile technologies. Founded in 2005, the company is rooted in Switzerland, and has global operations in Singapore, Turkey, the UK, US, China, Vietnam, Indonesia and Pakistan.

In 2010, Säntis Textiles developed spinnable 100% recycled polyester yarns for sun protection fabrics and home furnishing fabrics. The business has since then made a significant mark in the sustainability textile arena by developing the RCO100 technology in 2016, the first and only textile technology which allows for 100% mechanically recycled cotton, using both pre-and-post-consumer cotton waste to create 100% recycled cotton yarns and fabrics.

Not only is the RCO100 innovative technology in itself, it is also a testament of Säntis’ signature quality control measures throughout the full supply chain journey. Säntis prides itself on providing brands around the world with fully transparent circular solutions, offering the same level of quality as virgin cotton, but with a significantly reduced impact on the environment.

Säntis operates in several industries, in both technical and garment domains, so the company understands the volumes of textile waste that are produced every day and the impact that this has on the planet. With RCO100, Säntis’ main ambition is for the world to embrace, learn from and engage with this unique mechanical recycling technology and the 100% recycled cotton yarns and fabrics.

Säntis is a proud member of the global non-profit organisation, Textile Exchange, a community dedicated to improving and promoting leading standards in the fibre and material industry. The company holds several certifications to ensure the highest levels of production standards are upheld including Global Recycled Standard, ISO9001, Recycled 100, and Standard 100 by OEKO-TEX.

Säntis Textiles is committed to advocating for circular and closed-loop solutions as the only way forward for the textile industry while it continues to push for the highest environmental and ethical standards.