

MECHANICAL RECYCLING

What & How



PAKHUIS DE ZWIJGER*



BMA-TECHNE
Business Technology Development



INTRODUCTION

In the last chapter, we discussed the complex process of chemical recycling in the textile industry. In this section, we will describe the much simpler process of mechanical recycling. Unlike chemical recycling, mechanical recycling requires little water and no chemicals to transform textiles back into fibres.

FACTS

- Growing cotton requires 7,000 litres of water, 3.5 kg of CO₂-eq, and between 5-10 m² of agricultural land. Mechanically recycling cotton requires little to no water, no agricultural land and only 0.36 kg CO₂-eq.
- Mechanically recycled fibres can be used in most textile products. In fact, mechanically recycled fibres can make up around 10-20% of a product without impacting quality.
- Mechanically recycled textile fibres are already widely used in the textile industry. Industrial textile waste is often used for this purpose. In fact, you may own products made with mechanically recycled fibres without realising it!

MECHANICAL RECYCLING

Mechanical recycling is the process by which fabric (woven, knitted or non-woven) or yarn is broken back down into fibres using mechanical action. This process is performed in machines containing several pinned rollers of varying sizes that rip the textile pieces apart.

As it moves through the machine, textile waste is shredded into finer and finer pieces. Rollers further along in the production line are equipped with a much higher number of finer pins than those on the first rollers. The last roller might be equipped with sawtooth-like pins to better break down the yarn into fibres. While no chemicals are needed for this process, oil or water is occasionally used to reduce the friction between the fibres, resulting in gentler processing.

Mechanical recycling is still the most widely used technology for recycling textiles. The resulting fibres are predominantly used for low-quality applications, like sound and thermal insulation. Mechanical recycling remains the most popular method because any material and blend of fibres can be processed this way at a relatively low cost. This technology is not only low cost, but has also been used for over 100 years to recycle industrial textile waste.

The mechanical recycling of post-consumer waste, however, is a much more recent phenomenon. Because post-consumer waste involves a wider variety of textile materials and the demand for higher quality recycled fibres is growing, mechanical recycling technology must be improved considerably in the near future. This broader spectrum of post-consumer textile waste is also why advancements in sorting technology are becoming increasingly important.

INPUT TEXTILES

FOR MECHANICAL RECYCLING

Theoretically, mechanical recycling machines can process any type of discarded textile. However, in order to attain a useable final product, it is better to exclude certain types of textiles:

- Coated textiles, like rainwear or blackout curtains, are very difficult to process because the yarns and fibres in the fabric are glued together by a coating.
- Products with PVC content, like PVC plastisol printed T-shirts and jackets, should be avoided as users of the end-product (like companies that manufacture non-wovens) reject these materials.
- Products with down and feathers, like cushions and duvets, are difficult to process because a large part of these products are not made of textiles.
- Polyester multifilament products, like sportswear and (polyester) microfibre jackets, are best recycled using extrusion or chemical recycling. The mechanical recycling of multifilament products will only result in a fluffy material not suitable for further processing.

The better defined the input for mechanical recycling, the higher the quality of the output. The higher quality the output, the more applications the final recycled product will have.

THE OUTPUT

OF MECHANICAL RECYCLING

The desired output of mechanical recycling are long textile fibres, preferably of one colour and in large amounts. The quantity is important because the greater the volume, the cheaper the processing will be.

However, mechanical recycling often results in shorter fibres mixed with different yarns. This output is well suited for the production of the non-woven materials used in sound insulation, thermal insulation, and pressure distribution. You find these kinds of nonwovens in cars (e.g. door panels, dashboard, rear dash, and trunk), in washing machines, refrigerators, dishwashers, mattresses, chairs, and in carpet underlayments. With such a wide variety of uses, there's a fair chance you're already using a tremendous amount of recycled textile fibres.

THE FUTURE OF MECHANICAL RECYCLING

The future of mechanical recycling will be not only to provide fibres for the non-woven industry, but also for the textile yarn spinning industry.

For yarn spinning, recycled textile fibres must meet much more stringent guidelines regarding purity, the presence of foreign particles, and reproducibility (i.e. the same quality must be met every time). Foreign objects, like pieces of metal from zippers, can destroy the fragile card clothing in the spinning preparation. The average fibre length must also be higher because longer fibres produce stronger yarn and allow finer yarns to be spun. These finer yarns fetch a higher price and can be used in more applications.

The mechanical recycling of denim jeans is relatively popular because of their ubiquity and uniformity. An enormous amount of jeans is sold each year and nearly all of them are dyed indigo blue! As a result, more and more fibres from recycled jeans are used in the production of new jeans.

Fibres from recycled jeans, mixed with either virgin cotton fibres or polyester fibres from PET-bottles, can comprise up to 40% of the materials used in new jeans. Mud Jeans is very transparent about their production process and their use of recycled fibres ([click here for more information](#)).

The Alliance for Responsible Denim (ARD), based in Amsterdam, is also promoting the use of post-consumer recycled denim in their products. Here is [a video](#) providing some insights into the process. The goal of ARD is to produce over a million pairs of jeans with at least 20% recycled content in 2021.



Above: Mechanical textile recycling machine at Frankenhuis. (Photo by Alcon Advies)

DO'S AND DON'TS FOR MECHANICAL RECYCLING

- Reuse, repair, and refurbish textile products as often as possible.
- Buy second-hand textile products in shops and through apps.
- Always drop off your discarded textiles at a textile collection bin.
- Support recycling initiatives where possible and buy textile products with post-consumer recycled content. They are labeled with the GRS certificate and/or with the REMOkey.

For more information about REMOkey, see www.remokey.com.

MECHANICALLY RECYCLED FIBRES

CAN MAKE UP AROUND

10-20%

OF A PRODUCT WITHOUT

IMPACTING QUALITY

[#facts&figures](#)