



Sustainable Material Guide // 04 Polyester

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Credit: Ginetex



Polyester

Material Properties

Man-made Fibre – Synthetic



Lightweight



Wrinkle resistant



Stain resistant



Durable & long-lasting



Low impact – requires less water, energy and heat for washing



Low absorbency allowing for fast drying

Introducing polyester



Polyester is a manmade fibre, synthesized from petrochemical products by a process called polymerization. Polyester is derived from crude oil petroleum and is a non-renewable resource. It is processed through a system called 'cracking' which treats the petroleum through intensive heating and cooling, fuel, solvents, pressure and catalysts to break down the molecular structure.

Once polymerized, polyethylene terephthalate PET (think water bottles) is created in a liquid form. This liquid can then be extruded, dried and chopped into small pellets and is ready to be melt spun through industrial spinnerets. Once cooled and hardened, it forms a polyester yarn that can then be woven into a textile. Although most sources of polyester are petroleum based, some alternatives include recycled plastic (most commonly referred to as rPET), or bio-based polyester from agricultural crops or waste.

Using polyester

Accounting for nearly 50% of the global fibre production, polyester is the most widely used fibre in the apparel sector; more than 63,000 million tonnes of polyester fibre are produced annually.

In 1941 the first ever polyester fibre called Terylene was invented by chemists just after the discovery of nylon. When polyester was commercially introduced to America in 1951, it was hailed as the miracle fibre due to its ease of washing and wrinkle resistant properties. Within the first 20 years of its founding, a host of mills and various companies developed their own polyester fibres to accommodate the demanding market.

Its popularity still continues to grow, and polyester is the most commonly used fibre globally and accounts for approximately half of the fibre market worldwide today¹. Polyester is a low cost synthetic fibre that can be manufactured quickly, and it has grown in popularity alongside the rise of fast fashion.

1. *Chemical Economics Handbook, Polyester Fibres.*



Credit: Pantone



Key facts



Polyester production

China is the world's largest producer of polyester, producing 68% of the world's polyester polyamide and acrylic fibers. Asia accounts for 86% of global consumption¹.



Recycled polyester

China is currently the top producer of recycled polyester, taking up 69% of the market in 2017². Germany is the second largest exporter of recycled polyester, and the USA is the third².



Landfill

350,000 tonnes of clothing go to landfill every year in the UK alone, roughly 55-65% made from polyester.

1. The Global Leather Goods Market 2017-2021 Report, Technavio.

2. Future Trends in the World Leather and Leather Products Industry and Trade, UNIDO.

The environmental impact of polyester



1 / Land and energy

While synthetic plastic-based fibres do not require agricultural land or water for growth, they do have negative environmental impacts in other areas. Processing polyester requires a lot of energy for heating and cooling which significantly contributes to greenhouse gas emissions. Compared to cotton, polyester emits nearly 3 times as many GHG emissions overall¹.

For synthetics, the fashion industry is reliant on non-renewable fossil fuel extraction, with polyester sometimes being considered a conflict material due to its roots in the oil industry. Synthetics are also not biodegradable, so most polyester clothing ends up in landfill.



2 / Microplastics

As a synthetic plastic, polyester faces the issue of shedding microfibrils and small particles with every wash. These little 1 mm fibres are known as microplastics and are being found in every ecosystem around the world.

It is estimated that around half a million tons of microplastics are shed into the oceans yearly through waste water², and 35% of primary microplastics are released during washing cycles. These chemicals and plastic particles are then eaten by small fish, and consequently moved into larger food systems, including human food cycles. To minimise the amount of microplastics and chemicals passing through our ecosystems,

Credit: Polina Tankilevitch, Pexels.



companies have created special laundry bags (such as the GuppyFriend) or laundry balls (such as the Cora ball) to capture the shedded fibres.



3 / Recycled polyester

Polyester can be either mechanically or chemically recycled using pre or post consumer waste. However, according to the Textile Exchange Preferred Fibre Materials Report 2017, only 7% of all polyester used is recycled. When chemically recycled, the PET flakes are broken down into the base chemical molecule, which then goes back into the original polyester manufacturing system.

The most common form of recycled polyester is known as rPET, which comes from discarded clear plastic bottles instead of raw petrochemicals. Polyester fabric recycling, where the actual polyester yarn is recycled, is less common. In this case polyester scraps and textiles are broken down into fibre components that can then be spun into the recycled yarns.

1. Common Objective, Fibre Briefing Polyester.
2. Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future.

The rPET recycled polyester process

1

Selection

PET bottles are selected and sorted into bales at recycling centres and then sent to specific PET recycling facilities. Clear bottles are selected for their neutral base that allows for dyeing.

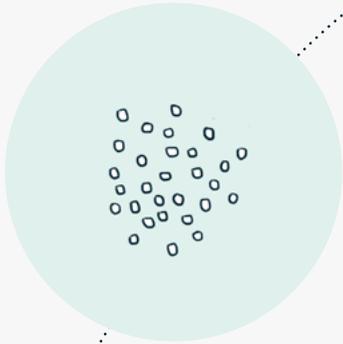


3

Shredding

The bottles are shredded into flakes using a mechanical bale breaker. The flakes are cleaned once again and thoroughly checked so they have zero impurities.





4

Processing

They go through a de-polymerisation and re-polymerisation process to be turned into PET chips. These PET chips or pellets can be used to make clothing, insulation, new water bottles, etc.



5

Melting

The pellets are passed through a spinneret and melted and cooled into fibers, which are then smoothed, stretched and placed on reels.



6

Yarn

The recycled yarn is ready to be used and woven or knitted into fabric again, and has the same aesthetics and functional performance as conventional polyester yarn.



It is estimated that in 2016 2.9 billion plastic bottles were diverted from landfills to be recycled back into polyester yarns¹.



¹. The Textile Exchange

Virgin Polyester

It is derived from crude oil petroleum and is synthesized by a process called polymerization.

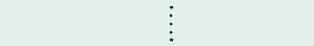
It is a non-renewable resource. Producing plastic-based fibres for textiles uses an estimated 342 million barrels of oil every year¹.

Processing polyester requires a lot of energy for heating and cooling (125MJ/kg²) which significantly contributes to greenhouse gas emissions. Compared to cotton, polyester emits nearly 3 times as many GHG emissions overall (14.2 kg of CO₂/kg produced²).

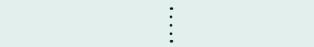
Plastic takes 400 years to degrade. It is estimated that only 7% of all polyester used is recycled. Main options for recycling are mechanical recycling and chemical polymer and monomer recycling.



Raw material



Production



End of life

Recycled Polyester

This reduces the dependence on petroleum and diverts PET bottles from landfill. It is estimated that at current rates, there will be 12 billion metric tons of plastic in landfills by 2050.

Converting PET into recycled polyester uses less water, less energy and emits less GHGs than the production of virgin polyester, thus reducing soil contamination and air and water pollution.

Similar to virgin polyester, the main options for recycling are; mechanical fibre recycling and mechanical and chemical polymer recycling.

1. Statista, Global oil production from 1998 to 2015.

2. Common Objective, Fibre Briefing: Polyester.

Designing a collection with polyester?

Here are 5 things to consider.



Credit: Sarah Pflug, Burst.



1 / Raw material

Opt for recycled or bio-based polyester for reduced environmental impact compared to virgin polyester. Using recycled polyester yarn reduces its energy consumption by 30-50%¹, by reducing extraction of oil and unnecessary landfill disposal.



2 / Traceability

Tracing polyester along the supply chain all the way back to the raw source is often very difficult, but bio or recycled polyesters allow for more traceability and transparency through new technology.



3 / Mono-Materials

If working with virgin or recycled polyester, aid mechanical recycling by using 100% polyester instead of a poly-blend that cannot be separated. Blending biodegradable fibres (eg. cotton or wool) with non-biodegradable fibres (eg. Polyester or nylon) creates challenges in recycling.



4 / Washing

Think about care labels and highlight its useful properties of not needing to be dry-cleaned. Polyester can be washed in cold water and air dried quickly. Encourage less frequent washing and using special laundry bags or laundry balls to collect the microfibres.



5 / Post-consumer Recycling

As polyester is not bio-degradable and most ends up in landfill, consider a take-back scheme to close the loop and ensure reuse. Design for durability and optimal recyclability.

¹. Textile Exchange Preferred Fibre Materials Report, 2017.



Key Certifications



RECYCLED CLAIM STANDARD

An international voluntary standard that sets a standard for recycled materials across the entire supply chain.



GLOBAL RECYCLED STANDARD

Must contain a minimum of 20% recycled material, and each stage of the production process is required to be certified.



OEKO-TEX STANDARD 100

Goes beyond legal legislation and tests for chemicals that are harmful to health but are currently not legally recognised and controlled.



Innovative Companies



EVRNU

Evrnu is a textile innovations company that has invented a new kind of fiber made from discarded clothing called NuCycl, enabling garment-to-garment recycling for polyester.



WORN AGAIN

Worn Again technology can separate, decontaminate, and extract polyester polymers and cellulose from cotton, non-reusable textiles, PET bottles, and packaging. They are then turned into new textile raw materials.



REPREVE

Repreve transforms recycled plastic bottles into a performance fibre, used by leading brands to make athletic and fashion apparel.

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