

Fashioning a Better world: Sustainable Plant-based Alternatives to Animal-derived Fabrics

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In a recent blog, we highlighted the widespread [use of materials derived from our animal kin in the fashion industry](#). Thankfully, tastes and attitudes are changing, and a growing number of individuals and companies are exploring sustainable alternatives to animal-derived fabrics.

So, what are the alternatives to skin, feathers, and fur? Which fabrics are truly sustainable? Are there ethical issues of which we need to be aware, even with plant-based fabrics?

Let's take a look.

Plant-based materials

Organic cotton

The number of [people wearing organic cotton rose by 20%](#) between 2021 and 2022 – and for good reason.

Organic cotton grows without the use of chemical pesticides or fertilisers on land cleaned of previously used chemicals. The resulting material is biodegradable, renewable, and widely available.

According to [HipSwan](#), a company that makes performance socks from organic combed cotton, a major focus of the organic cotton industry is “Using growth methods that restore and preserve soil fertility and create biologically diverse agriculture”.

Before buying organic cotton:

The quality and environmental impact of organic cotton varies based on where it's grown and how it's manufactured. Organic cotton requires significant water and land resources for cultivation, so we need to be mindful of how this is managed within the supply chain before we buy.

Look for garments with the [Global Organic Textile Standard \(GOTS\) certification](#) because this ensures that the product has at least 70% certified organic fibre content and that it was made using environmentally friendly production processes.

GOTS certification also means that there are no toxic inputs such as heavy metals or solvents and that there are good work conditions and social compliance in the entire supply chain.

Hemp

Hemp is one of the most durable natural fabrics and has been used for thousands of years to make hardwearing items such as ropes, sacks, and clothes. It is a type of bast fibre that comes from the stems of specific plants and has been referred to as the [“sober cousin”](#) of the marijuana plant!

In fact, hemp and marijuana derive from the same species of plant, but hemp refers to strains that contain less than 0.3 percent tetrahydrocannabinol (THC) by dry weight. It's the presence of cannabinoids such as THC – the chemical responsible for marijuana's psychological effects – that resulted in the US making it illegal to grow hemp but not to import it.

Hemp has many benefits as a fabric – it protects your skin by naturally filtering UV light, resists bacterial growth (great for preventing odours!), is four times stronger than cotton, and retains colour better than any other fabric.

Does hemp have any environmental downsides?

In terms of sustainability, it's hard to find any downsides to using hemp. It's a fast-growing, abundant plant that produces ten tons in 100 days on just one acre of land without the use of harmful chemicals. It's also high in cellulose, which removes considerable amounts of carbon from the atmosphere by supercharging photosynthesis.

Better still, it takes one-twentieth of the amount of water needed by regular cotton to grow and process hemp. Indeed, hemp can be rain-fed rather than requiring additional water use. It can also be grown in the same place for 20 consecutive years without affecting the quality of the soil!

The only downsides to using hemp as a fabric are that it can be coarse and less versatile in terms of texture and drape than some other fabrics. It may also be expensive because of its low demand and availability and because it requires treatments to stay soft and elastic.

Linen

Linen is a textile made from fibres derived from the stem of the flax plant.

As its production is relatively time and resource-intensive, it's typically seen as a much more luxurious fabric than hemp. It becomes softer and stronger the more it is used and can absorb a large amount of water before it feels damp. It also releases moisture into the air much quicker than animal-derived wool, which makes linen a fantastic fabric to dry quickly on the washing line and keep the wearer cool.

On the downside, linen can wrinkle quite easily and may require more care when washing.

Is linen environmentally friendly?

Linen is generally seen as a highly sustainable, environmentally friendly fabric.

Like hemp, flax plants can be grown in as few as 100 days without the need for fertilisers or pesticides. The plant also helps to take carbon from the atmosphere (the linen grown in Europe is estimated to remove [250,000 tonnes of CO2](#) from the environment every year).

Linen is 100% biodegradable and recyclable, and the entire flax plant can be woven into fibre, creating a waste-free material.

Not all linens are created in the same way, though. Some manufacturers do apply pesticides and fertilisers to speed up the growth or use dyes containing harsh chemicals to achieve stronger colours.

Because flax grows successfully in the European climate, people living in Europe should be able to add linen to their wardrobes without the carbon emissions from shipping and transportation stacking up. Currently, though, France exports a sizeable proportion of its flax to China before the linen makes its way back into circulation in Europe – this affects the carbon footprint of some linen products as well as working conditions, so it's important to check the supply chain.

Before you buy your next linen item, look for sustainable labels such as the [Global Organic Textile Standard](#) (GOTS), [USDA Organic](#), [Masters of Linen®](#), [Belgian Linen](#) or [Irish Linen](#).

Piñatex (pineapple leather) and Piñayarn (pineapple wool)

Piñatex and Piñayarn are both innovative vegan textile solutions made from pineapple leaf fibres, a by-product of the agriculture industry.

Piñatex is a vegan leather that has passed ISO international testing standards for tear and tensile strength, endurance, colour fastness, seam rupture and finish adhesion, making it comparable with animal-derived leather without any of the associated cruelty.

Piñayarn is a vegan yarn that has a closed-loop production process and uses a dry spinning technique that doesn't require water or chemicals. This means it is a genuinely zero-waste fibre suitable for use in a range of fashion products, including clothes and shoes.

Are pineapple-derived textiles sustainable?

As we've already mentioned above, Piñatex and Piñayarn are sustainably made with no additional environmental resources needed to create the raw material. They are also vegan products made without the use or exploitation of our animal kin.

While this is all fantastic news, there are still widespread [concerns that workers are subject to exploitation](#), poor working conditions, low pay, and [denied basic labour rights](#) on a number of pineapple farms. For this reason, it's vital to research the supply chain before you buy products made from pineapple leaf fibres.

Cork

[Cork comes from the bark of cork oak trees](#) and is a sustainable alternative to petroleum-based foams and plastics. This material is naturally moisture-wicking, insulating, fire-resistant, odour-repellent, buoyant, cushioning and biodegradable, making it ideal for use in footwear.

One of the fantastic benefits of cork is that there's no need to cut down trees to harvest it. Instead, farmers cut away the bark of the tree, which regrows over a period of nine to 12 years. The photosynthesis necessary to create this regrowth sucks five times more carbon from the air than a cork oak tree that has yet to have its bark harvested. For every kilogram of cork produced, a cork oak tree absorbs approximately 55kg of carbon from the atmosphere.

Are there any ethical issues to consider when buying fashion items made from cork?

Cork seems to rank at or near the top of plant-based materials when it comes to being great for the environment, sustainable, free from cruelty to other animals, and associated with the fair treatment of workers.

Knowing how to [harvest cork bark is a skilled task](#) passed down between family generations. This means the workers can command a better wage than most other agricultural workers because they're not easily replaceable by machines or unskilled labourers.

In addition, cork farmers often choose to rewild areas of cork forests during the years that the bark needs to replenish. This leads to thriving ecosystems with diverse species.

The only downside of using cork within the fashion industry is that it has limited flexibility in terms of texture and design options.

Seaweed-based fabrics (e.g., SeaCell)

Innovative designers and manufacturers are looking to the sea as well as the land for renewable plant-based materials.

Seaweed-based fabrics such as [SeaCell](#) are derived from sustainable seaweed sources and are entirely compostable and biodegradable, as well as being made using closed-loop processes.

SeaCell is a soft, moisture-regulating fabric that gives a high level of comfort when used in sportswear and loungewear. Currently, seaweed-based fibres tend to be woven into other materials to create a blend.

Is SeaCell sustainable?

As a relatively new fibre, there are still some unknowns when it comes to the [environmental impact of seaweed-based products such as SeaCell](#).

Responsible producers harvest the Icelandic seaweed used in SeaCell every four years and cut above the regenerative part of the plant to ensure healthy regrowth. They also use a special type of blade to protect the remaining plant.

SeaCell, as one example, does use some chemicals to preserve the nutrients in the fibres, but they're contained within the closed-loop production process rather than released into the environment. As a result, SeaCell has received several sustainability certifications.

While seaweed-based fibres are vegan, they're often woven into animal-derived yarns, such as cashmere, to make garments more lightweight and breathable against the skin. For this reason, you may need to shop around to find truly vegan seaweed-based fabrics.

Wood pulp fibre materials

Some fibres used by the clothing industry are made from wood pulp.

[Modal](#) is a type of rayon (fabric made from purified cellulose fibres) referred to as semi-synthetic as it's made using a combination of organic (high-quality cellulose from beech trees) and synthetic materials. It goes through a complex manufacturing process before it becomes weavable fibre.

There are standard modals produced in various countries around the world, and the most sustainable and ethically produced version is TENCEL™ Modal.

TENCEL™ also produces Lyocell, which is a 100% natural rayon made primarily from cellulose derived from eucalyptus, beech, and bamboo wood pulp. These fast-growing tree varieties do not need irrigation or pesticides and grow well on challenging terrain.

Are cellulose/wood pulp fibre-based materials sustainable?

Currently, Modal's eco-credentials depend on who is making it and how it's made. [According to The Ecohub](#), it's best to avoid standard modals made in China, Indonesia, and Pakistan. The toxic chemicals used to produce modal in these countries have a devastating impact on workers, local communities, waterways, and ecosystems. There are also concerns about companies sourcing wood pulp from endangered ancient forests.

Ethical fashion brands will usually state that they use TENCEL™ Modal in their products. The Lenzing Group responsible for the TENCEL brand sources its wood and pulp from sustainable sources certified by The Forest Stewardship Counsel (FSC) and Programme For The Endorsement of Forest Certification (PEFC).

However, the Lenzing Group does outsource some of its pulp production, making it harder to identify the source. In addition, because TENCEL™ Modal isn't available as a ready-to-wear fabric, it's sold for use with other materials, which may not be sustainable.

Right now, even TENCEL™ Modal is not a fully sustainable or environmentally friendly material because of the synthetic elements and the production process. It is, however, seen as one of the more sustainable fabrics in widespread use and has become a popular alternative to non-organic cotton or viscose.

According to [Make Fashion Better](#), Lyocell is sustainable, organic and biodegradable. It's processed by "a low energy, low water, closed loop system that recycles 99.5% of the chemicals/solvents used, with the remaining 0.5% discharged as non-hazardous effluent".

TENCEL™ Lyocell is the most sustainable version of this fabric.

More exciting cruelty-free fabrics

These are the most widely available sustainable and ethically produced plant-based fabrics in the fashion and textile industries today. However, other innovative materials are gaining traction, including apple and mushroom leathers.

Indeed, there are so many exciting developments and materials to explore that we'll be talking about them in part two of this blog next month.