This factsheet informs you about the environmental issues of the production of man-made fibers. It provides you insight in the comparison of the different fibers and a range of concrete alternatives and actions for reducing the envi-

The textile case

Man-made fibers have quickly become a considerable part of the market share. Today, they are more than one third of the total world production of textile fibers. Man-made fibers are divided into two types:

- Viscose and related cellulose-based fibers (half-synthetic)
- Synthetic fibers like polyester, nylon and acrylic

Viscose is the best known cellulose fiber. Variants are modal, lyocel (tencel), rayon (cupro) and acetate. The cellulose that is needed to produce these fibers is extracted from pine trees. Fibers can also be extracted from bamboo, an example of this can be Monocel (a combination of bamboo and Lyocell). The wood pulp from the pine trees (or bamboo) is treated chemically and dis-solved in different ways to spin the cellulose fiber.

The different types of synthetic fibers are made from base- chemicals (ester, amide, acryl), which are derived from crude oil and natural gas. PET, Polyamide (Nylon) and Polypropylene are all plastics made out of crude oil, which is a non-renewable source. Besides, those synthetics are also made with a lot of hazardous chemicals. If you want to know more about alternative fibers, please refer to the factsheet ‘Recycled Fibers’.

Cotton and wool
Man-made fibers
Recycled fibers
Energy use
Water use
Waste water
Chemicals use
Social Compliance

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- What to focus on and how to improve?
- Inform the consumer
- Get informed, aware, inspired and challenged

 Provided by:

MODANT
The environment issue

Use of resources and land
In Europe, almost all cellulose is extracted from pine trees farmed in production forests. If this wood is produced sustainably, the biodiversity impact is strongly reduced and acceptable. However, uncontrolled deforestation can cause erosion and depletion of soil. Non-renewable fossil fuels are used to produce synthetic fibres. This use contributes to a small extent to the depletion of oil reserves.

Energy consumption
Energy consumption affects the environment through depletion of resources and emissions to air, including the emission of carbon dioxide (CO₂) which is a greenhouse gas and contributes to climate change. Overall, all man-made fibres (both synthetic and cellulose-based) score relatively bad on energy consumption when compared to cotton. Tencel and Modal (new viscose fibres) are an exception to this rule and wool takes a mid position.

Water and chemicals
Synthetic fibres score reasonably well on water input, where cellulose based fibres require a lot of water during the manufacturing process.

Many chemicals and chemical processing is involved in the manufacturing of the fibres and spun yarn, ranging from solvents causing air pollution, to chemicals and heavy metals (causing water pollution). Especially a lot of chemicals are used for (bamboo) viscose.

The supply chain approach
We should have a critical look at the production processes of man-made fibres and their potential environmental impact. Some suppliers of these fibres will have taken more steps to reduce energy use and the use of hazardous substances than others.
What to focus on and how to improve?
There are three ways of managing environmental issues:
A. Product design and fabric selection
B. Screening, selecting and working with suppliers
C. Inform the consumer about ways to reduce environmental impact

A. Product design and fabric selection

The clear option for man-made fibres is to choose materials with a lower environmental impact, which have a better environmental performance.

A tool that can help you in making a choice is the Fibre Benchmark (MADE-BY):
The Fibre Benchmark compares the environmental impact of the most commonly used fibres in the garment industry, supporting you to shift to more sustainable alternatives. Twenty-eight fibres are ranked on six parameters: greenhouse gas emissions, human toxicity and eco-toxicity (20% weight), energy, water and land use (13.33% weight). The fibres are placed in Class A (best) to Class E (worst), fibres in ‘Unclassified’ are not able to be ranked, yet.

The ranking is largely underscored by a recent Life Cycle Assessment (LCA) on the Dutch textile consumption. The recycled versions of fibres do have the lowest environmental impact. The bio-based alternative PolyLactic Acid (PLA, made from corn or beetroot) also has a better environmental profile than virgin polyester. So, if you go for renewable, this is a ‘safe’ choice, although recycled polyester scores better.

Comparing the viscose fibres gives preference to Ten-cell* and viscose from Lenzing* above regular viscose.

It should be realized that the environmental profile of the naturals are very different. Since cotton and wool are renewable materials it gives them a sustainable feel and image. But, in calculations the water use (cotton), land use (cotton and wool) and climate change emissions (sheep breeding) give cotton and wool a low score on environmental issues. Oil-based synthetic fibres have a negative image because of the depletion of oil reserves.

*B: Lyocell (Lenzing brand-name: Tencel) is a new fabric in the field of cellulose fibers. The cellulose fibers are directly dissolved and spun for production. Almost all solvents can be reused, which is why the production of Lyocell is more environmentally friendly compared to viscose.

B. Screening, selecting and working with suppliers

The second way to manage the environmental impact of man-made fibres is to include the environmental performance in the screening and selection of suppliers and to work with them to improve their performance. There are three ways to do this:

1. Choose suppliers with a credible certificate
2. Check with suppliers their policy and performance
3. Work with suppliers to implement improvement measures
**B1. Choose suppliers with a credible certificate**

Although there are no certificates in the textiles sector that focus specifically on man-made fibres, there are certain textile standards that include requirements relevant to (the production of) man-made fibres.

**Oeko-Tex Standard 100**

The Oeko-Tex Standard 100 is an independent testing and certification system for textile raw materials, intermediate and end products at all stages of production. Textile products are certified according to Oeko-Tex Standard 100 only if all components meet the required criteria without exception. This standard is one of the top benchmarks for product safety with a transparent certification system. The website provides information on certified suppliers.

**EU Ecolabel for Textile products**

The European Ecolabel for Textile products (including clothing) has set environmental criteria that define the best in class in this product group (for a comparison with Oeko-Tex Standard 100 click [here](#)). The label addresses all fibers thus including man-made cellulose fibers and synthetic fibers. When you can put an EU Ecolabel on your product it meets the following requirements, like: a limited use of substances harmful to the environment, limited substances harmful to health, textile shrink resistance during washing and drying, and colour resistance to perspiration, washing, wet and dry rubbing and light exposure.

**Cradle to Cradle**

Products with a Cradle to Cradle certificate have passed the assessment on product safety to humans and the environment, as well as its design for material reutilization like recycling or composting. The Cradle to Cradle Certified Product Standard evaluates the design of a product, next to the practices employed in manufacturing the product. This evaluation system is divided in five categories, namely: Material Health, Material Reutilization, Renewable Energy & Carbon Management, Water Stewardship, and Social Fairness.

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**B2. Check with suppliers what their policy and performance is on environmental impact**

You need to inform yourself about how your suppliers of yarn, fabric or clothing made from man-made fibres perform. You can get a good impression on your supplier’s environmental policy and performance by asking for information and raising some additional questions. Independently checked information is of course most reliable but you will be largely dependent on the supplier’s own information. For an expert opinion you can always consult a MODINT CR consultant.
B3. Working with suppliers to implement good housekeeping measures

Apart from a screening and selection of suppliers based on their environmental impact/ performance, companies may also work with suppliers to minimize (the) environmental impact. Of course, this also goes for the company’s own operations (show a good example, ‘walk the talk’). A few guidelines and even fewer alternatives to manage and reduce environmental impact can be explored.

BEPI
The Business Environmental Performance Initiative (BEPI), an initiative of FTA, is a business-focused platform for companies committed to improving environmental performance in supplying factories and farms worldwide. BEPI provides a practical framework for all sectors to improve environmental performance and reduce environmental risks.

BEPI covers, for example, the following environmental performance areas: Environmental Management System (Mandatory), energy use, water use, wastewater effluent, pollution prevention and chemicals, and major incident prevention and management.

Cleaner and sustainable production (click here) UNIDO (United Nations Industrial Development Organization) helps with the adaptation and adoption of Resource Efficient and Cleaner Production (RECP) methods, technologies and systems by enterprises and other organizations in developing and transition countries.

These contribute to:

⇒ Efficient use of natural resources, including materials, water and energy; and
⇒ Minimization of wastes and emissions, including those discharged to water, air or on land

Reduction of risks to humans and environment from use of chemicals and disposal of chemicals used in industry.

Their key services include: information dissemination and awareness creation; professional training; in plant assessments and demonstrations; policy advice; and support for the transfer of Environmentally Sound Technologies.
The following fibers and textiles are a few examples of sustainable options and alternatives.

**Eco Intelligent**
www.victor-innovatex.com
Eco Intelligent® Polyester is designed to remain in a closed-loop system of manufacture, reuse, and recovery, for value sustained through an unlimited number of product lifecycles. It is the first antimony-free polyester. It uses fully optimized dyes and chemicals, is chlorine-free and it is free of PBTs (chemicals that are persistent, bio-accumulative, and/or toxic). Eco Intelligent Polyester is certified Cradle-to-Cradle. Unfortunately, it still seems to be only available for home-textiles.

**Monocel**
www.monocel.com
Monocel is an internationally registered trademark for knitted, woven and denim fabrics, with Monocel as the main component. The Monocel yarn is made from lyocell bamboo fiber. It is a great alternative to, among others, cotton. Monocel is strong, soft and responsibly produced. The fibre production of lyocell is in a closed loop system. This means leaving no hazardous waste and significantly reducing water consumption, and the raw material, bamboo, is organically grown.

**Greenfil**
www.sofila.eu
Greenfil is made from Rilsan, which is made out of castor oil. Greenfil has the same characteristics as Nylon, but the source is renewable, which means the Greenfil fibres can be recycled. The tree, Ricinus, grows on dry ground (which is not suited for agriculture) in Europe, so less transport is needed.

**Sorona**
www.origin.dupont.com
Sorona is made partially with agricultural feedstock (e.g. corn) instead of petrochemicals, reducing the dependency on oil. Sorona contains 37% renewably sourced ingredients by weight.

**Natureworks LCC**
www.natureworksllc.com
NatureWorks turns carbon that is in the atmosphere, and contributing to global warming, into a portfolio of performance Ingeo materials. Also for clothing. The first step in this process is transforming atmospheric carbon into Ingeo, this involves using Agricultural crops to sequester the carbon. So, since Ingeo is made from plants, not oil, creating this apparel uses 50% less non-renewable energy & results in 60% less greenhouse gases.

**C. Informing the consumer about ways to reduce environmental impact**

Consumers can contribute to a reduced environmental impact of man-made fibres by buying certified products (e.g. OEKO-TEX certified, EU Ecoflower, Cradle-to-Cradle certified).

The number of mainstream consumers that is actively interested in buying sustainable textile is relatively small but increasing. Awareness on the environmental impact is growing like it did with the social issues. But, consumers generally hesitate to pay a higher price for environmentally friendly textile when shopping. In fact they count on the brands and retailers to pay proper attention to environmental protection.
...GET INFORMED, AWARE, INSPIRED AND CHALLENGED!

- If you want to work on your man-made fibers policy, you can even participate in the raw materials workgroup of the Dutch National Action Plan. [Join now!]

Designers
- Ask yourself the question: what do you want to make and which material is most suitable: which characteristics does it need to have? Can you choose for environmental friendly options?
- Work with a preferred fabric (supplier) list (created with MADE-BY fabric benchmark, Higg Index and/or MODINT’s RSL).
- If you search for a synthetic fibre check the availabilities of mechanical and chemical recycled options and polyester made from PET waste.
- If you search for a half synthetic, viscose-like fibre, ask for European produced Lenzing fibres, like Tencel and Modal.

Buyers/ Sourcers/Product managers
- Be aware of the environmental footprint of man-made fibres.
- Discuss with suppliers the applicability of their environmentally improved fibers and fabric for apparel.
- Aim on certified products and suppliers.
- For the man-made fibers it is important to adhere to OEKO-Tex Standard 100 and EU Ecolabel certifications, especially because of their chemical origin. You can try to discuss this with your regular supplier – or look for a supplier who works with it.
- A specific issue is the use of the heavy metal antimony in the polyester production. Several companies have come with a Antimony-free polyester, look for those companies.
- Consult the MODINT ‘Sustainable Fabric Supplier List’.

CR and Supply chain managers
- Check the supplier’s sustainability report and/or ask for information on: does the supplier have a policy on environmental impact of fibres used or produced, is this policy translated into specific targets on environmental impact, does the company use internationally recognized initiatives and labels, and to what extent, and is environmental impact monitored and reported?
- Verify the answers to these questions, preferably through a signed environmental policy – preferably part of an environmental management system (ISO-14001) and a verified CR report including specific environmental impact data and product and material related certifications and claims. It is important that this information can be considered reliable (‘no easy way-out on serious questions’).
- Verify traceability on production samples: is the Lenzing fibre from Lenzing Europe?
- Define if the environmental claim is from fibre to end product (including sewing yarns and accessories) if not what will the claim be on the product? Contact a [MODINT CR manager] for more information.

Management
- Develop a (man-made) fiber strategy towards increasing the use of more sustainable fibers.
- Train and inform employees: contact a [MODINT CR manager] for more information.
- Setting targets (priority) and providing means (budget).