9 tips on responsible chemical management in the apparel sector

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Thousands of chemicals are used in the production of textile raw materials and apparel products. Many are hazardous and may have a negative impact on worker safety, human health, wildlife and the environment. It is important that you manage chemicals responsibly for your employees and the environment, but also if you want to do business with European buyers.

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1. Understand why responsible chemical management is important

Hazardous chemicals can enter the environment through water, soil and air at any point during the lifecycle of an apparel item; from production to consumption to disposal. Chemicals that are used to produce apparel can pose risks to your employees in the factory, to surrounding communities, to end-consumers wearing the garments and to the environment.

What makes chemicals hazardous? They may be:

- Persistent (breaking down slowly and staying in the environment for a long time)
- Bio-accumulative (building up within organisms)
- Toxic
- Toxic to reproduction (affecting fertility and offspring development)
- Carcinogenic (causing cancer)
- Mutagenic (damaging DNA)
- Endocrine disruptive (interfering with the body's hormones)
- Respiratory sensitising (causing hyper-sensitivity of the airways)
- Skin irritants

Responsible chemical management

The goal of responsible chemical management is to manage and reduce the risks that can arise from the use of chemicals throughout the supply chain. Chemical management involves:

- Ensuring the safe and responsible use, storage and handling of chemicals
- Monitoring and testing wastewater quality
- Understanding and monitoring the chemical content within textiles and apparel products
- Taking steps to eliminate the use of harmful chemicals throughout the supply chain
- Adopting more sustainable materials that require fewer and/or safer chemicals to produce

Figure 1: Always provide employees with appropriate safety equipment and monitor its use

Source: Photo by Marianna Krzakiewicz on Unsplash

EU legislation on chemicals in textile products

The EU restricts the use of chemicals through strict and continuously updated legislation: EU REACH (EC 1907/2006). The EU Strategy for Sustainable and Circular Textiles (a building block of the EU Green Deal) aims to ensure that, by 2030, textile products placed on the EU market will be:

- Free of hazardous substances;
- Recyclable; and
- Mostly made from recycled fibres.

Chemical management is key to realising these ambitions. This is because the presence of hazardous chemicals in textiles could mean they cannot be recycled. A 2020 study led by H&M and IKEA tested samples of post-consumer cotton, polyester and wool materials that had been collected for recycling from various sources. The study found that hazardous chemicals were present in 88% (cotton), 90% (polyester) and 100% (wool) of the samples. In 2018, the EU generated an estimated 1.7 million tonnes of hazardous and unrecyclable textile waste, compared to almost 7 million tonnes in total textile waste (2020).

Zero Discharge of Hazardous Chemicals (ZDHC)

Manufacturers that can offer more sustainable materials and chemical transparency will have a competitive advantage. One important initiative that supports this process is 'Zero Discharge of Hazardous Chemicals' (ZDHC). ZDHC is an EU-based multi-stakeholder organisation with 204 signatories worldwide. It aims to stop the use of harmful chemicals in the apparel supply chain. ZDHC provides tools and guidance for brands and their suppliers to measure, improve and report on the compliance of chemicals used in the manufacturing process.

2. Familiarise yourself with the risks in your supply chain

The production of most raw materials (fibres) commonly used in the apparel industry requires a lot of chemicals. Textile wet processing (including preparation, dyeing and finishing) is estimated to be responsible for up to 65% of all chemicals used in the textile supply chain and up to 20% of global clean water pollution. As EU legislation is increasingly making importers into the EU responsible for any negative effects in their supply chain, this burden will also be on the manufacturer.

Table 1: The main categories of chemicals used in the apparel industry, their impacts and supply chain hotspots

	Function/source	Impact	Substance
Phthalates	Plasticiser: Softens or improves durability and flexibility of plastics	Endocrine disruptive Toxic to reproduction	Polyvinyl chloride plastics (PVC) Plastisol and screenprint inks Heat transfer inks Adhesives Plastic buttons Polymeric coatings
Formaldehyde	Anti-creasing agent Anti-shrinking agent Anti-stain agent Preservative	Irritant (skin, eyes, nose, throat) Respiratory sensitising Carcinogenic	Easy care products Polymeric resins Leather production
PFAS	Water repellence Stain resistance Oil repellence	Carcinogenic Endocrine disruptive Toxic to reproduction Generally toxic Highly persistent Bioaccumulative	Easy care products Finishing (fabrics/garments) Outerwear
Chlorinated Paraffins	Softener Flame retardant Fat-liquoring agent Plasticiser	Generally toxic Toxic to reproduction Endocrine disruptive Persistent Bioaccumulative	Leather production Synthetic polymer production
Biocides (incl. pesticides)	Destroy, deter or control harmful organisms (incl. bacteria, fungi and pests)	Generally toxic Carcinogenic Endocrine disruptive Toxic to reproduction Respiratory sensitising Skin irritant Persistent	Conventional cotton cultivation Leather production

Azo Dyes (degrading to form carcinogenic aromatic amines)	Provide strong and vibrant textile colours	Mutagenic Carcinogenic	Fibre, yarn and fabric dyeing
Heavy Metals	Dyes and pigments Tanning agents	Generally toxic Persistent Bioaccumulative Carcinogenic Respiratory sensitising Skin irritant	Leather production Pigments and dyes Metal alloys and coating PVC
Volatile Organic Compounds	Solvents Finishing agents Crude oil refining/processing	Generally toxic Toxic to reproduction Respiratory sensitising Skin irritant Carcinogenic (some)	Polyester production Solvent-based coatings and resins Glues/adhesives Dyes Finishings
APEOs (Alkylpnenol ethoxylates)	Scouring agents Wetting agents Softeners Dyeing/printing agents Dyes/pigment preparations Degreasing agents De-gumming agents Coating agents	Endocrine disruptive Bioaccumulative Toxic to reproduction	Silk production Leather production Pretreatment Dyeing/printing Down/feather fillings Polyester padding Coating
Flame Retardants	Decrease flammability	Generally toxic Toxic to reproduction Endocrine disruptive Carcinogenic Persistent and bioaccumulative (some)	Adhesives Coatings Foam Inks Plastics

Source: FT Journalistiek

Natural fibre production

The conventional production of most natural fibres requires fertilisers, fungicides, pesticides and/or insecticides. Cotton cultivation is responsible for 4.7% of the world's pesticide sales and 10% of its insecticide sales. A significant amount of pesticides are used in the animal rearing process for wool and leather. They are applied:

- Directly onto animals;
- In places where animals are kept;
- Onto crops destined for animal feed.

Synthetic fibre production

Volatile Organic Compounds (VOCs) are widely used in the production of synthetic and semi-synthetic fibres, including Man-made Cellulosic Fibres (MMCFs), such as rayon and viscose. VOCs are carbon-based compounds that readily evaporate at room temperature during textile production and throughout the garment lifecycle.

Leather processing (tanning)

The process of turning animal hides and skins into leather requires a wide range of chemicals. Formaldehyde is a raw material used in the manufacturing of many of these chemicals, including preservatives and tanning agents.

Biocides are used to prevent the growth of bacteria that can damage the hides or skins during the soaking process.

Heavy metals are used in the tanning process, such as Chromium (III), Arsenic and Barium. Chromium salts are the most widely used tanning agents applied in leather manufacturing today. They produce soft, supple leather that is durable and resistant to water. While Chromium III itself is not regulated by EU legislation, industrial processing can convert it to Hexavalent Chromium (Chromium VI), which is regulated. The formation of Chromium VI can occur during the tanning process if certain conditions are not properly controlled. Chromium VI is often used in the tanning process, but it is not allowed in the EU.

Pre-treatment/preparation of raw materials and fabrics

Pre-treatment is done on fibres, yarns and fabrics to:

- Remove impurities, fats, wax and grease (scouring)
- Strengthen plant fibres (mercerising)
- Enable dyes and other chemicals to adhere better

Chemicals used include bleaches and APEOs

Dyeing and printing

Up to 70% of all textile colourants are synthetic azo dyes. These dyes produce strong, vibrant colours. However, some types of azo dyes can be carcinogenic under certain circumstances.

In the dyeing process, APEOs are used as agents to:

- Ensure that compounds do not separate (emulsifying agents)
- Disperse the dyes (dispersing agents)
- Improve colour brightness

- Improve dye penetration (impregnating agents)

The dyeing process is also a major source of:

- VOC emissions
- Heavy metals, including cadmium, lead and mercury (found in pigments and dyes)
- Phthalates (used in screen prints, heat transfer inks and plastisol inks)

Material/garment finishing

Chemicals used in the finishing process can improve a fabric's appearance, hand-feel and performance, such as softening agents, whitening agents and fixing agents. Many of these emit VOCs. Other chemicals provide additional functionality by giving the fabric or garment safety or easy-care properties. These include: flame retardancy, moisture management, stain/oil/water repellence, UV protection, wrinkle resistance and anti-microbial, anti-yellowing, anti-pilling and anti-static properties.

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are used in finishing to provide water and oil repellence and stain resistance. It is estimated that up to 10% of textiles in the EU have been treated with PFAS in the manufacturing process. PFAS are often called 'forever chemicals' because they bioaccumulate and are highly persistent. Recent and upcoming changes to EU chemical legislation include a significant focus on this category of substances.

Denim dyeing and finishing

Harmful chemicals are used in the production of synthetic indigo dyes for denim production. These dyes are suspected of releasing cancer-causing phthalates and aromatic amines. Formaldehyde is also often used to help denim garments retain their colour and to give them wrinkle-free or stain-resistant properties.

Various finishes and distressing techniques have been applied to enhance denim products over the years by creating unique colour fading and other characteristics. Many of these use harmful bleaching chemicals to create these effects, such as potassium permanganate.

Tips:

The Apparel and Footwear International RSL Management Working Group (AFIRM) is an organisation dedicated to reducing the use and impact of harmful substances in the apparel and footwear supply chain. Its website provides a lot of resources for suppliers to help them understand and implement safe chemistry, including downloadable factsheets for each chemical category.

The ChemSec website provides information about the different chemical categories as well as a tool for evaluating the hazardous nature of specific textile chemicals

3. Understand your (and your buyer´s) legal obligations

When it comes to the use of chemicals in apparel production, your European buyers need to comply with strict European legislation. And thus so do you. Many chemicals have strict allowable limits and reporting requirements under the following EU chemicals legislation.

- The EU POP Regulation 2019/1021 restricts the use of Persistent Organic Pollutants (POPs). These are organic substances that persist in the environment and accumulate in living organisms. They pose a risk to

human health.
- The EU REACH Regulation 1907/2006 is the world's strictest law relating to chemical substances in consumer goods, including textiles.

The most important REACH lists

There are three lists that companies need to be aware of to ensure compliance with the REACH regulation:

- Restricted Substances List (REACH regulation Annex XVII)

  Substances that are considered to pose a substantial risk to human health and the environment are listed in Annex XVII. They are either banned or restricted and have maximum allowable limits.

- Candidate List of Substances of Very High Concern (SVHC)

  Substances under investigation that may pose serious risks to human health or the environment but are not regulated yet are placed on the candidate list. Importers and suppliers have the following obligations when an article contains one or more of these substances in quantities above 0.1% by weight:

  - Notify the European Chemicals Agency (ECHA);
  - Register the product(s) in the SCIP hazardous substances database;
  - Notify the buyer and provide information to enable the safe use of the article;
  - Provide information to allow the safe use of the article to a consumer within 45 days of receiving a request.
- Authorisation List (REACH regulation Annex XIV)

  The Authorisation List includes substances considered to be particularly risky. These substances require special authorisation before they can be used within the EU. Authorisation is only granted if there are no available suitable alternatives.

Additional legislation

Additional legislation under the umbrella of the EU Green Deal and the EU Circular Economy Action Plan (CEAP) focuses on transparency and sustainability reporting. The following pieces of legislation are also relevant for chemical substances.

- Digital Product Passports

  From 2026, all textile products placed on the EU market will need to have an individual Digital Product Passport (DPP). A DPP is a digital information record of a product's complete life cycle. This will include all sustainability-related data, such as information on materials and manufacturing processes.

- Corporate Sustainability Reporting Directive

  Adopted in November 2022, the Corporate Sustainability Reporting Directive requires companies of a certain size or level of business in the EU to disclose information about their climate and environmental impact alongside their financial reporting. They will need to report this data in a standardised format for auditing by a third party. The rules will be implemented in phases between 2024 and 2028.

- Green Claims Directive

  In March 2023, the European Commission adopted a proposal for a Green Claims Directive (GCD) aimed at preventing brands and retailers from making false or exaggerated sustainability claims towards consumers

('greenwashing'). It requires companies to back up their environmental claims with data. The aim is to help buyers and investors make more sustainable decisions and increase consumer confidence in green labels and information.

In response, brands have started to map out their supply chains and capture impact-related data from upstream suppliers. All stakeholders in the value chain have to ensure they have the systems and tools in place to efficiently collect and share data.

Tips:

Legislation is often updated. Check the EU's web page about its textile strategy to stay up to date. As a supplier, it is your responsibility to be fully aware of the content of relevant legislation and keep up with all changes applicable to your product range.

The Candidate List of Substances of Very High Concern (SVHC) is updated twice per year.

Since Brexit, the UK has developed its own REACH regulation.

Switzerland has its own chemical legislation: the Chemical Risk Reduction Ordinance (ORRChem) 2005.

Test your products before the start of production.

Figure 2: Using closed-loop systems reduces the risk of employees coming into contact with hazardous substances and creates opportunities for recycling waste streams

Source: Giovanni Beatrice

4. Understand your buyer's requirements regarding chemical management

European buyers are held responsible for their use of hazardous chemicals in their supply chains. As a result, they are increasing their requirements for suppliers. This means that you, as a supplier, have to adhere to standards, certifications and legal restrictions that apply to your operations. More importantly, you also have to monitor and report on your suppliers.

(Manufacturing) Restricted Substances Lists

Hazardous substances that are not yet restricted under legislation may be included in the AFIRM restricted substances list (RSL) and the ZDHC manufacturing restricted substances list (MRSL). These lists are the most important guidance documents for apparel brands, retailers and suppliers.

Most brands have developed their own Restricted Substances List (RSL) and Manufacturing Restricted Substances List (MRSL), largely based on these lists. These lists are distributed to suppliers annually (via the buyer manual). Every chemical used in the production process has to meet the MRSL requirements, and all products delivered to the buyer have to meet the RSL requirements. Buyer MRSLs and RSLs are increasingly

going beyond legislation, in line with best practices and industry aspirations.

Workplace health and safety standards

Many buyers will audit their suppliers to assess whether their chemical safety procedures are aligned with buyer and industry health and safety requirements. These requirements focus on how hazardous substances are used, handled and stored. Follow these instructions to ensure your processes and procedures comply:

- A Safety Data Sheet must be displayed for every chemical, and it should include:
  - Identification of hazards
  - Information on ingredients
  - First-aid measures
  - Fire-fighting measures
  - Appropriate response to leaks, spills and releases
  - Precautions for safe handling and storage
  - Recommendations for personal protective measures/equipment (PPE)
- Chemicals should be clearly and properly labelled
- Chemicals should be stored safely
- PPE should be provided free and should be used
- Workers should be given training on safe use, handling and storage of chemicals
- General housekeeping should be adequate
- There should be a plan for chemical emergencies

Transparency and traceability

Opportunities are increasing for suppliers to differentiate themselves and add value by focusing on creating a fully transparent supply chain. For example, Swedish retailer H&M has committed to achieving full traceability of the chemicals used in the production of its goods by 2030. It intends to share this information and wastewater discharge test results with its customers.

By collecting and sharing reliable data on chemicals used in their operations and those of upstream suppliers, manufacturers can help brands and retailers measure and report on their progress more accurately. Currently, the most effective ways to provide chemical transparency are:

- Product/component certification
- Facility certification
- Chemical inventory list
- Upstream supplier management
- Product testing
- Wastewater discharge testing

Tips:

Make sure you have a clean and organised workplace at all times as some audits are unannounced.

Do your own risk-based testing on received materials.

Ask your material suppliers for confirmation of material compliance or a test report from a third-party laboratory.

Contact your suppliers and explain that you need formulations to comply with the latest ZDHC MRSL limits.

Some substances have stricter limits for babies and children under three years of age (including formaldehyde, heavy metals and pesticides). Make sure you comply with the specific legislation if you produce children’s clothing.

Safe chemistry for materials is not limited to components and fabrics. AFIRM publishes and maintains a packaging RSL.

5. Develop and implement a chemical management system

A chemical management system (CMS) is a set of rules, procedures and tools that help you track and control inputs (chemicals used), monitor outputs (wastewater, finished products) and promote responsible chemical use. It provides a framework for continuous improvement.

Create alignment within the company and the supply chain

A chemical strategy that outlines your priorities and targets is an essential part of any chemical management system. Develop relevant policies and standard operating procedures (SOPs) based on this strategy. These should cover every aspect, from purchasing to incident management. Review them every year to make sure they comply with legislation and best practices. Do not forget to share your policies and procedures with your suppliers.

Develop and maintain a chemical inventory List

A chemical inventory list (CIL) should contain information about any chemicals used and stored in your facility. Use this information to make sourcing decisions, to ensure the safe use of chemicals and to assess ZDHC conformance levels. A CIL is an important first step towards identifying and implementing safer alternatives to harmful chemicals.

Ensure proper handling, use, storage and disposal of chemicals

Manufacturers should conduct regular internal audits to monitor and assess conformity with legal and buyer requirements regarding the safe handling, use, storage and disposal of chemicals and chemical waste. Provide training regularly to ensure the correct implementation of policies and procedures. Proper disposal of waste should include chemical waste as well as wastewater and packaging waste from chemical products.

Ensure proper treatment and testing of wastewater

Wastewater from wet processing should be properly treated, either on or off-site to ensure safe disposal and/or recycling. If wastewater is treated on-site, it should be regularly tested to ensure that all requirements are met.

The ZDHC Wastewater Guidelines set expectations for wastewater discharge quality in the textile industry, including limits for the presence of certain chemicals. They are publicly and freely available, and they include recommendations regarding sampling, testing and reporting methods, as well as how often this should be done. ZDHC tools allow suppliers to share their wastewater test results in a standardised format.

Risk assessment and product testing

As part of their commitment to responsible chemical management procedures, brands randomly test imported products. Non-compliance with RSL requirements usually results in the business relationship being terminated. Suppliers with effective chemical management systems regularly conduct their own product testing based on risk assessments.

Tips:

Research facility certifications and chemical management audit criteria to understand requirements.

Key personnel (including management) should participate in a short ZDHC training programme to understand the importance of and best practices in chemicals management.

ZDHC provides a chemical inventory list template, which is free to download from its website.

Separate ZDHC guidelines are available for Man-Made Cellulosic Fibre (MMCF) suppliers, including wastewater guidelines and responsible fibre production guidelines.

6. Gradually replace hazardous chemicals with safer alternatives

European brands work with suppliers to replace toxic chemicals with lower-impact alternatives that are MRSL compliant. A growing number of these alternatives are listed on the ZDHC Gateway, which is the world's largest database of safer chemicals for the textile industry. Suppliers can use ZDHC tools to check their chemical inventory's conformance with the ZDHC MRSL and provide buyers with proof of conformance with an MRSL conformance report.

Brands are developing new key performance indicators (KPIs) to measure and report on their progress in chemicals management. These include:

- Percentage of suppliers with chemicals inventory and MRSL conformance reports
- Percentage of chemicals used in supply chain that meet ZDHC MRSL requirements
- Wastewater compliance rate (wastewater testing)
- Number of ZDHC supplier Gateway accounts connected with the brand

ZDHC Gateway account registration is free for suppliers and manufacturers. However, sharing performance data with connected brands may involve a fee.

Tips:

Discuss whether there are any safe, suitable substitutes that meet your chemical production needs with your chemical supplier(s).

Ask your supply chain partner to invite you to the ZDHC Gateway and send you a registration link. If you do not currently work with a ZDHC signatory brand, contact the ZDHC customer support team at support@zdhc.org to assess your eligibility.

Do not forget that ZDHC is focused on training a single person or team in your company and does not certify the company.

Be transparent about your sustainable chemical journey. Communicate your targets and progress with your buyers and on your website proactively and openly. Refer to brands' and competitors' websites for inspiration and ideas about messaging and key performance indicators.

7. Source materials with a lower chemical impact

There are a variety of materials with relatively low impacts available. No material is 100% impact-free, and each has its own technical and supply challenges. However, they represent a step forward in helping European

buyers reduce their materials' chemical footprint. The Textile Exchange's Preferred Fibre and Materials Matrix is a useful tool for assessing the sustainability credentials of different fibre types.

Organic cotton

Organic farming prohibits the use of synthetic pesticides and fertilisers. Global organic cotton fibre growth reached 37% in 2021 compared to the previous year. Organic cotton is fast becoming a standard requirement for more sustainable brands. The main certification for organic textile fibres is the Global Organic Textile Standard (GOTS), which requires products to be made of a at least 70% certified organic fibres in order to carry the GOTS label. There were 14,676 GOTS-certified facilities worldwide in 2023.

As demand exceeds supply for certified organic cotton, ever more brands are supporting in-conversion cotton, produced by farmers in the three-year process of moving towards organic practices.

Mechanically recycled fibres

Recycling fibres eliminates the use of chemicals associated with natural fibre cultivation or synthetic fibre extraction and processing. According to the Textile Exchange's preferred fibres and materials matrix, GRS-certified mechanically recycled cotton and polyester have the highest chemistry performance levels of all preferred cotton and polyester fibres, including organic cotton. A certain amount of dyeing is often still required. Mechanical recycling produces shorter fibre lengths, which reduces their strength.

Bioplastics made from non-food crops and food waste

Bioplastics are manufactured using bio-based polymers made from renewable organic resources instead of petroleum. Most commercially available options come from food crops that need pesticides and fertilisers to grow. However, a new generation of bioplastics uses forestry or food crop waste and by-products as inputs. Because these are not cultivated specifically for bioplastic production, it can be argued that these kinds of bioplastics have a much lower chemical impact.

Bio-based leather alternatives

New, more sustainable, plant-based leather alternatives are coming onto the market. These can be derived from agricultural by-products and waste. None are produced at scale yet, but examples of materials that have reached the pre-commercial or early commercial stage include: Piñatex (pineapple *leaves),* Vegea (grape leftovers from winemaking) and Uppeal (apple waste). Most plant-based leather alternatives use a certain amount of bio-plastics (usually derived from food crops that use pesticides and fertilisers) and/or PU coating.

Vegetable-tanned leather

Vegetable tanning involves replacing chromium with bark or plant tannins. It does not replace the many other chemicals used in the process, but it is thought to be more sustainable than aldehyde tanning. Aldehyde tanning uses formaldehyde, which is a highly toxic restricted substance. The proportion of chrome-tanned leather fell from 85% to 75% over a period of six years (from 2014 to 2020), and this trend is expected to continue.

Lower impact man-made cellulosic fibres (MMCFs)

Lyocell (also known as TENCEL™) is a man-made cellulosic fibre produced from the pulp of the eucalyptus tree. Unlike rayon, which is made using more common viscose processes, Lyocell production does not use carbon disulfide – a toxic volatile organic compound (VOC). The manufacturing process also occurs in a 'closed-loop system' in which up to 99.5% of dissolving agents can be reused.

Tips:

Check the CBI studies on Sustainable Materials, Recycled Fashion, Sustainable Cotton and Leather

Accessories for more information on the environmental impact of different materials and lower-impact alternatives.

Ask your customers about their forecast requirements for organic cotton and discuss the possibilities around using in-conversion cotton.

Use the Textile Exchange's Preferred Fibre and Materials Matrix or the MODINT Fibre Matrix to get an understanding of the potential reduction in impact different fibre and material alternatives offer.

The Higg Materials Sustainability Index (MSI) is the industry's most trusted tool for selecting materials. It calculates environmental impacts (including those related to chemicals) and translates it into Higg MSI scores. A subscription is required.

8. Use certification to prove chemical compliance

As a manufacturer, you can use standards and certifications to prove to buyers that you comply with requirements to manage chemicals responsibly. There are several standards that focus on sustainable chemistry and compliance. They are based on the following criteria: testing of finished products, components and/or chemical inputs; assessments of inputs and production processes; and assessments of conditions at facilities.

The Oeko-tex System

Oeko-tex is the most widely used and recognised system for verification of chemical compliance in the textile industry.

Chemical products used in the manufacture of textile products can be tested and certified under the Oeko-tex ECO PASSPORT Standard. This standard verifies conformance to safety, sustainability and regulatory compliance requirements. ZDHC recognises the ECO PASSPORT as a level three indicator of ZDHC MRSL conformance (highest level). As a result, ECO PASSPORT-certified formulations can be listed on the ZDHC Gateway.

Components and finished products can be tested for harmful substances against criteria set out in the Oeko-tex 100 Standard, the Oeko-tex Leather Standard or the Oeko-tex Organic Cotton Standard. The set of criteria included in the Standard's Annex 4 sets limits for the presence of chemicals that are harmful to human health. The Oeko-tex 100 standard also includes alternative (stricter) criteria, which include chemicals with no direct impact on human health but that can have a harmful impact on the environment (Annex 6).

A valid Oeko-tex product certificate (valid for 12 months) will cover the requirements of most buyer RSLs. The standards are available to download for free.

The Oeko-tex STeP certification verifies facilities for chemical management, environmental management and social responsibility, including fair and safe working conditions. Products can carry the Oeko-tex label if they are Oeko-tex certified and the facility is Oeko-tex STeP certified.

The Bluesign Partner Network

The Bluesign system assesses companies' textile value chains – from chemical suppliers to brands – to determine whether they can be included as Bluesign system partners. Approval is based on the Bluesign criteria, which include legal compliance, social responsibility, occupational health and safety, management systems, emissions and waste, process control and chemical management. Reassessment is required every two to three years.
Bluesign certifies its system partners' chemicals, colourants or auxiliaries based on threshold limits for specific

substances in the chemical product. ZDHC accepts that this certification indicates conformance with its highest level of MRSLs (level 3). Like the Oeko-tex ECO PASSPORT, certified formulations can be listed on the ZDHC Gateway.

Bluesign system partners' components are certified after production recipes are checked to ensure that Bluesign-approved chemical products are used, and after spot tests of potential risks are performed. Bluesign system partners' finished products (garment) can be certified if 90% of the fabrics and 30% of the other components are Bluesign approved.

The main difference between this and the Oeko-tex system is that the Bluesign system tackles the problem of harmful chemicals at its root (the chemicals used in production), rather than simply testing the components and finished products. However, Bluesign-approved finished products can still include some unsafe fabrics or components.

Global Organic Textile Standard (GOTS)

After a successful audit, the certification body will issue a scope certificate to the supplier allowing for its participation in the GOTS programme. This certification is valid for 12 months. For any individual shipment of goods, the supplier has to apply to the certification body to issue a transaction certificate. Transaction certificates declare that the goods under individual shipments meet all GOTS criteria. GOTS criteria cover the following key areas:

- Fibre content requirements
- Requirements for additional fibre types
- Prohibited and restricted inputs (the GOTS RSL)
- Chemical management
- Environmental management policy
- Wastewater management
- Human rights and social responsibility
- Segregation, storage, packaging and transport of GOTS goods

Tips:

A list of GOTS-approved certification bodies can be found here. Contact different certification bodies to compare costs.

If you plan to become Oeko-tex or Bluesign certified, check if other certifications and standards (e.g. SA8000 and BSCI) are recognised by these systems to avoid audit duplication.

Be aware that certifications require a yearly fee. Create a certification strategy based on your buyer's requirements and your priorities.

Check the CBI study Tips to go green for more information on how to make your production more sustainable.

9. Keep up to date with new developments and innovations

Chemical management in textile factories is constantly updated based on: new technologies (automated machinery, AI); new products (sustainable alternatives to conventional chemicals); legislation, standards and best practice guidelines. It is important to keep yourself informed about developments. The best way to do this

is to subscribe to newsletter updates from key organisations that are responsible for setting these requirements and guidelines (e.g. ECHA, AFIRM, ZDHC, OEKO-TEX, BLUESIGN and GOTS).

The European Union is also home to some of the industry's most active multi-stakeholder initiatives that drive research and collaboration in sustainable innovations. Examples include Fashion for Good, Laudes Foundation (formerly C&A Foundation), H&M Foundation, Cascale (formerly the Sustainable Apparel Coalition) and the Ellen MacArthur Foundation. By following these initiatives, you can make sure that you are the first to know about new opportunities and best practices.

Ellen MacArthur Foundation

In 2021, the Ellen MacArthur Foundation set a challenge for 100 brands, retailers, garment manufacturers and fabric mills to collaborate on a project to redesign jeans to make them fit for a circular economy. The result of the Jeans Redesign project was the publication of a set of best practice guidelines. These include:

- Self-assessment of chemical selection;
- Meeting ZDHC MRSL level 1 requirements (as a minimum);
- Applying the ZDHC wastewater guidelines at fabric mills;
- Replacing conventional harmful finishing processes with lower-impact alternatives, such as laser finishing, ozone finishing and enzyme finishing.

There are detailed reports on how individual manufacturers and mills are implementing these guidelines. For example, Tunisian manufacturer Demco has developed and marketed 17 styles of jeans that meet the Jeans Redesign guidelines, including wastewater quality, the use of ZDHC-compliant chemicals and the phasing out of potassium permanganate spray. The company has reduced chemicals use by 50% through the adoption of new technologies. Of its chemical inventory, 98% is now ZDHC compliant.

Fashion For Good and H&M Foundation

The Fashion For Good Innovation Platform and the H&M Foundation Global Change Award work to find, support and scale early-stage sustainable innovations. In addition to supporting the development of a significant number of innovative, low-impact sustainable materials and digital tools, these initiatives have supported the following technologies and processes directly related to responsible chemistry.

Input chemicals:

- Creation of ethylene glycol (key input for polyester production) from waste carbon dioxide (Fairbrics)
- Bio-based alternatives to the petrochemical polyurethane for use in adhesives and coatings (Algreen)

Pre-treatment and finishing:

- Plasma technology that replaces bleaching in the pre-treatment process (GRINP)
- Use of micro-organisms to convert organic waste into enzymes for de-sizing and scouring (Fermentech Labs)
- PFAS-free water/oil-repellence chemistry, coatings and/or membranes (OSM Shield, Lamoral Coatings, Dimpora)
- Digital solutions for dyeing, pre-treatment and finishing (Alchemie Technology)
- Anti-mould/bacterial/viral and insect repellent finishes made from forestry industry waste (Nordshield)
- Technology that eliminates the need for binder chemicals to attach finishes onto fabric (Sonovia)

Dyeing/Dyes:

- Waterless dyeing solutions that result in less dye and/or chemical use (Dyecoo, eCO2Dye, Deven Supercriticals, NTX Cooltrans)

- Digital-enabled spray dyeing technology that offers reduced chemical use (Imogo)
- Reuse and recycling of dyes and pigment directly from textile waste for use in the dyeing of new fabrics (Dyerecycle, Deakin University 'Denim dyed denim')
- Dyestuffs made from used apparel and textile scraps (Officina 39, Recycrom)
- Processes, pigments and dyes that use natural and/or bio-based inputs including plants, plant waste, bacteria, wood waste, microorganisms and algae (Ever Dye, Sodhani Biotech, Living Ink, T-Hues, KBCols Sciences, Indidye, Algaeing, Vienna Textile Lab, Nature coatings, Colorifix, Pili-bio)
- Less chemical-intensive indigo dyeing processes and/or natural indigo dyes (Stony Creek Colours, Huue)
- Dyeing process that eliminates the need for Potassium Permanganate spray for creating denim finishing effects (CleanKore)
- Production of inks and pigments from carbon dioxide emissions (Graviky labs)

Tips:

Subscribe to newsletter updates of the large testing houses, such as SGS, TÜV and Bureau Veritas, to stay informed about any changes to legislation, certification systems or best practices.

The Jeanologia EIM (Environmental Impact Measuring software) for garment finishing processes is a platform and tool that helps laundries, garment finishers and brands calculate the chemical impact of finishing processes and build more sustainable ones.

Material District and Springwise are good sources of information on new sustainable and circular innovations, including fibres and materials.

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