

# ECO-FRIENDLY TEXTILES: A BOOST TO SUSTAINABILITY

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This article presents an overview of the textile industry highlighting major processes, techniques and practices that are used to make textile industry more sustainable.

There is an essential need to identify the stages in various steps of textile production that are said to be the greatest cause for environmental degradation with a special focus on substances that are likely to cause harm to eco- balance.

Now a days various processes, techniques and practices related to textile production have been developed to cure the world from being affected by the hazardeous effects of chemicals etc. which are either used in textile industry or released as a by-product by the textile industries. These all sustainable methods and techniques need to be adopted by the textile industries in order to save environment and to foster sustainability in the field of textiles.

**Keywords:** Sustainability, Textiles, Eco-Friendly fibers, Green dyes

## **What are Sustainable Textiles**

Sustainable textiles are textiles (or fabrics) that are grown and created in an environmentally friendly way, using minimal chemicals. Because chemicals are not used in sustainable textiles, there are less health problems that are associated with chemicals such as headaches, allergies, skin irritation, and respiratory problems.

For a textile to be sustainable, it has to be made from a renewable resource, it has to have a good ecological footprint (how much land it takes to bring it to full growth and support it), and it should not use any (or use little) chemicals in the growing and processing of it.

The most suitable definition of sustainability recommended by the world Commission on Environment and Development is **‘meet the needs of the present without compromising the ability of future generation to meet their needs and desires’**. (World Commission on Environment and Development u.d.)

In recent times sustainability is a leading characteristic of textile fashion products. Textile fashion companies are focusing more on sustainable products these days, so that they can meet the environmental and social aspects. For getting competitive advantage in fashion business the companies have to take care of social, political and economical issues, and they must be aware of current trends of the market. Sustainable fibers provide solution for the companies facing issues regarding environmental problems; these fibers are also favorable to meet the market demands of quality products these days.

## **❖ Some sustainable textiles include:**

- **Organic cotton** -- conventional cotton is very environmentally unfriendly as the extensive use of pesticides and insecticides used when growing the cotton cause pollution and also ill health. Organic cotton however is grown without the use of chemicals, making it much more environmentally friendly.
- **Hemp** -- pesticides or insecticides are not needed when growing hemp and hemp actually improves the condition of the soil that it is grown in. It is also drought resistant and can be grown in most climates. The fabric can be made from the hemp plant without using toxic chemicals and it can be processed locally, reducing the costs and pollution associated with transport.

- **Bamboo** -- as a plant, bamboo is very fast growing, helps to improve the quality of the soil, and can help to rebuild eroded soil. It is very sustainable. Bamboo fabrics can be made mechanically or chemically. Because strong solvents are used in the chemical method, it is not considered a sustainable way to create fabric. However, there are newer manufacturing methods that are environmentally friendly. Look for a label from an organic or sustainable certification body.
- **Soya** -- soya cloth is made from a by-product that occurs during the food manufacturing of the Soya bean. The fabric is soft, drapes well, and is comfortable. Look for soya cloth that is certified organic.
- **Wool** -- can be an environmentally friendly fabric with some conditions – the animals need to be treated well and live in humane conditions. The sheep manure should not enter the water supply. Another consideration is how the wool is manufactured – environmentally friendly wool will not use bleach or chemical dyes.
- **Pina fabric:** Pineapple leaves are used to obtain Pina, a textile fiber that is used to make fabrics. The pina fibers are extracted from the pineapple leaves by hand scraping, decortications or retting.

#### ❖ An introduction to Rare Eco-Friendly Fibers:

- **Stinging Nettle Fiber:** This fiber is obtained from the Brennessel plant which is naturally resistant to vermin and parasites. It can be grown without pesticides and herbicides and with very little fertilization as the minerals do not get leached out of the ground. They can be mixed with organic cotton and spun into yarn. Nettle fiber is stronger than cotton and finer than linen fiber. They can be made into a wide range of woven as well as knitted fabrics. Due to its fine weft and glossy look, nettle fabric was very popular in middle ages but lost its position to inexpensive cotton. Now again, it is becoming popular as sustainable alternative to cotton.
- **Milk protein fiber:** These fibers are used to make yet another and eco-friendly yarn- The milk yarn. Milk is dewatered, i.e. all the water content is taken out from it and then skimmed. With the help of bio-engineering technique, a protein spinning fluid is made. Wet spinning process converts this fluid into high-grade textile fiber. The skin friendly milk yarn goes to make glossy and luxurious fabrics similar in appearance to silk fabrics that have antibacterial and antifungal properties too. Their hygroscopic character makes them one of the finest moisture management fabrics. They can be blended with a number of fibers to get many characteristics- blend them with bamboo to get cool fiber and with wool fiber to have a thermal protective fiber.
- **Banana fiber:** The banana fiber is extracted by hand stripping and decortications. Thus, it is 100% eco-friendly fiber. This fiber looks like bamboo fiber and ramie fiber. It is strong, shiny, lightweight and bio-degradable. It can even absorb moisture very efficiently. Banana fibers were used for making ropes and mats till recent past. With its many qualities getting popular, the fashion industry is also fast adopting this fiber for making various fashion clothing and home furnishings.

#### ❖ Sustainable technologies and practices includes:

##### ❖ **Green dyes**

- Extraction from plants
- Extraction from arthropods and marine invertebrates (*e.g.*, sea urchins and starfish)
- Extraction from algae (*e.g.*, blue-green algae)
- Production from bacteria and fungi

##### ❖ **Processes**

- Cold Pad Batch preparation and dyeing
  - Continuous processing of knits
  - 1&2 stage vs. 3-stage preparation of wovens
  - Combined scour & bleach for knit and yarn
  - Foam dyeing, finishing and coating
  - Pad/dry vs. pad/dry/pad/steam
- ❖ **Chemicals and Dyes**
- Cat ionization for salt-free dyeing
  - Stable chemistries for 1 or 2-stage vs. 3-stage prep
  - High fixation dyeing with reduced salt
  - Enzymatic desizing and scouring
  - Size recovery and recycle
  - Liquid indigo and sulfur dyes
  - Pigment printing and dyeing
  - Right First Time (RFT) dyeing
- ❖ **Equipment**
- Low liquor ratio jets with LR <8/1
  - Low liquor ratio package dyeing with LR <6/1
  - Filtration of process water for recycle
  - Caustic recovery and re-use
  - Insulated dyeing, drying & stenter machines
  - Solar heating of water
- ❖ **Systems, Control & Management**
- Empowered environmental teams
  - Automatic dyes and chemicals dispensing
  - Advanced equipment and process control
  - Various system approaches to reduce WEC
- ❖ **Waste Water Treatment**
- Physical, biological and activated carbon systems
  - High technology filtration systems
  - Recycle internal process water
  - Waste water treatment sludge used/sold for fuel
- ❖ **Coloration and Eco- Friendly Bleaching**
- ❖ **Reduce, reuse and recycle**
- ❖ **BIO PROCESSING OF TEXTILES** - Bio-processing can simply be defined as the application of living organisms and their components to industrial products and processes, which are mainly based on enzymes. Like-
- **Enzymatic Desizing-** by using Amylase bacteria.
  - **Enzymatic bio scouring ( by using lipase/cellulase enzyme)-** saves water by 30% and energy upto 60%, less fabric weight loss & strength loss, better fabric quality and enhanced color brightness after dyeing & low TDS in discharge.
  - **Enzymatic bleaching-** Catalases/lactases for removal of H<sub>2</sub>O<sub>2</sub>) saves water, energy, shorten bleaching process cycle, eco friendly process and consistent bleaching result, saves chemicals.

- **Bio polishing and Enzymatic based softeners (Cellulase) etc-** enzymatic bio-finishing yields a cleaner surface, softer hand-feel, reduces pilling and increases luster.
- **Bio-Stone Washing (Denim Finishing)-** Using a special **cellulase enzyme** instead of pumice stones. Cellulase works by loosening the indigo dye on the denim in a process known as 'bio-stonewashing'. A small dose of enzyme can replace several kilograms of pumice stones. The use of less pumice stones results in less damage to garment, machine and less pumice dust in the laundry environment; in addition, it's possible to fade denim without risk of damaging the garment.
- **Decolorization of Dye House Effluent by Enzyme-** Laccase enzyme produced from fungi like *Trametes Modesta* or *Trametes Versicolor* etc as Fungi are used for dye decolorization in effluent treatment which is major factor for environmental issue.



#### **Air Dye Technology:**

**AirDye** technology manages the application of color to textiles without the use of water. It was developed and patented by Colorex, a California-based sustainable technology company. The process of making textiles can require several dozen gallons of water for each pound of clothing. The AirDye process employs air instead of water to help the dyes penetrate, a process that uses no water and requires less energy than traditional methods of dyeing, the technology works only on synthetic materials.

- **Key Features of AirDye technology:**
  - Does not pollute water in the color application process. By using air instead of water to convey dye, no hazardous waste is emitted and no water is wasted.
  - Greatly reduces energy requirements, thereby lowering costs and satisfying the strictest standards of global responsibility.
  - Does not use boilers, screen printing machines, drying ovens, or cleaning and scouring chemicals, thereby eliminating major sources of pollution.
  - Eliminates water in the color application step and simplifies the process, creating revolutionary possibilities of new industry and employment in unfarmable, arid regions of the world.
  - Gives consumers a way to choose style and sustainability at a realistic price at the point of purchase, thereby initiating world change.



#### **Herbal Textile:**

Herbal Textile is dyed entirely with herbal extractions, without using any sort of chemicals. The herbs used are different from vegetable dyes as they are not only natural but also have medicinal value. These herbs are applied directly to the fabric with the help of natural ingredients, so that the medicinal value of the herbs can be kept intact. No chemical process is adopted while dyeing. Even bleaching of cloth is done naturally by exposing it to sunlight. The herbs also do not pollute the environment through contamination of water resources in areas close to processing units. All kinds of shades of red, yellow, brown, orange and green etc. can be prepared with the help of these herbs.

- **Healing Effect of Herbal Textiles:**

Herbal textile is dyed with herbs having medicinal property, it is but natural that the end products made through it will definitely have some or the other health benefits. Herbal Textile can, in fact, fight diseases like hypertension, heart ailments, asthma

and diabetes depending upon the herb used to make the dyes. Some of the examples will help to understand these healing effects of herbal textile.

- Indigo: This herbal dye helps fight skin disease.
- Cuscus Grass: It helps fight asthma
- Turmeric: It can cure pain and is also beneficial for enhancing skin qualities
- Sandalwood: It's mild fragrance has a soothing effect that helps in fighting stress

Some of the other herbal dyes are catechu, pomegranate, tamarind, madder, castor oil, sweet basil, lime, wild turmeric, henna, curry leaf tree, aloe, certain herbal fruits etc. have their own healing effects.

### ❖ New range of Eco-Fabrics :

Relying on polluting textile materials like cotton and polyester may become a thing of the past as a new range of eco-fabrics emerge, often made from materials that would otherwise go to waste. Some of these environmentally friendly fabrics are already in use, like those made of coconut husks, recycled plastic bottles, wood pulp and corn, while others are strange and futuristic, sourced from hagfish slime, fermented wine, spoiled milk and genetically engineered bacteria.

#### • **Fabric from Fermented Wine**



A group of scientists at the University of Western Australia has produced fabric by letting microbes go to work on wine. The scientists culture bacteria called Acetobacter in vats of cheap red wine, and the bacteria ferments the alcohol into fibers that float just above the surface. These fibers can be extracted and fashioned into clothing. The only catch? Acetobacter produce vinegar as its end product, so the garments have a definite odor.

#### • **Naoron, Durable Fabric Made of Wood Pulp**



This leather alternative is not only animal-friendly, it also eschews the chemicals required to create conventional faux leather. Naoran is a water-resistant textile derived from wood pulp and recycled polyester. It's soft, flexible, and tear- and water-resistant.

- **Hagfish Slime Thread**



The slimy substance in the photo above is defensive goo attached to a hagfish, an eel-shaped bottom-dwelling animal of the deep seas that is the only known creature to have a skull, but no vertebral column. Scientists have discovered that proteins within this slime have mechanical properties rivaling those of spider silk, and can be woven into high-performance bio-materials.

- **Spider Silk Made from Metabolically Engineered Bacteria**



Known for its tremendous strength – three times stronger than both steel and Kevlar, yet thinner than a human hair – spider silk is a highly valuable material for textiles. But farming and harvesting spider silk is a definite challenge. Instead, geneticists have found a way to chemically synthesize the silk gene and insert it into E. coli bacteria.

- **Ingeo, Fabric Made from Corn**

Synthetic fibers are most often petroleum-based, but recycled fibers and those sourced from natural substances are on the rise. Ingeo, a fabric by Natureworks derived from fermented corn starches, can be spun into fibers for apparel and home textiles, and also used for bio-plastics

- **Silk-Like Fiber Derived from Spoiled Milk**



(images via: [milkotex](#))

Few of us would willingly walk around wearing spoiled milk, but it might just become all the rage in the near future. A company called Qmilch makes fabric from protein found in soured 'secondary milk' that's no longer suitable for human consumption, and would normally be thrown away. This zero-waste fabric requires no harmful chemicals to make, and uses less water in the production process than other milk-based fabrics.

- **Newlife Polyester Yarn Made of Recycled Plastic Bottles**

Newlife is a polyester yarn made from 100% post-consumer recycled plastic bottles, which is processed by mechanical rather than chemical means. Made in Italy, the fabric is used in fashion, sportswear, underwear, medical garments and other clothes and furnishings. Giorgio Armani used it to create a fashionable, eco-friendly gown for Livia Firth at the 2012 Golden Globe Awards.

- **Used Coffee Pods**

Inspired by the resourcefulness of locals in Kerala, India, who repurpose waste in surprising ways, designer Rachel Rodwell discovered a material that wasn't living up to its potential: used coffee pods. Rodwell gathers pods from friends and family and smashes them with a meat tenderizer, reconfiguring them into geometric-inspired designs in colors that reflect India's cultural aesthetics.

- **Recycled Newspaper Yarn**

Artist Ivano Vitali tears recycled newsprint into strips and twists it into balls of yarn without the use of glue, dyes or silicone, crocheting them into textile art with custom-made wooden knitting needles and hooks as long as 8 feet. Recently, Vitali has expanded into wearable art, achieving certain colors for dresses, jackets and even bikinis by painstakingly sorting his printed materials by color.

- **Self-Repairing Textile**

Once a protective garment like a raincoat or lab wear is ripped or torn, it's useless. But the total loss of these garments may become a thing of the past with the creation of 'intelligent' fabric that can heal itself. Researchers at SINTEF added microcapsules containing a glue-like substance to the plastic polyurethane that is applied to modern rainwear, so that if the garment snags, the capsules release a sealant that fills in the gaps and hardens with contact to air and water.

- **Cocona, Made of Coconut Husks**

It was only a matter of time before tough, fibrous coconut husks were made into durable fabric. Cocona is one trademarked example, made of coconut-husk waste disposed of by the food service industry. The fabric is lightweight and breathable, making it ideal for sportswear. It's used in Nau's insular jacket.

- **Lab-Grown Biological Textiles**

How will biotechnology change the fashion industry? Designer Amy Congdon believes that in the future, we'll be able to grow textiles like ethical fur in laboratories. Her series 'Biological Atelier' imagines a workshop, circa 2082, where high-fashion garments are grown from cells.

- **Recycled Cassette Tapes**

All of the strands of cassette tape still floating around in the world could not only be reused for fabrics, but spun into 'audio textiles' that play back under a tape head. Artist Alyce Santoro weaves this unlikely material on antique looms in a family-run textile mill in England to produce 'Sonic Fabric', including purses made from sound collages based on life in New York City.

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