

Module 3

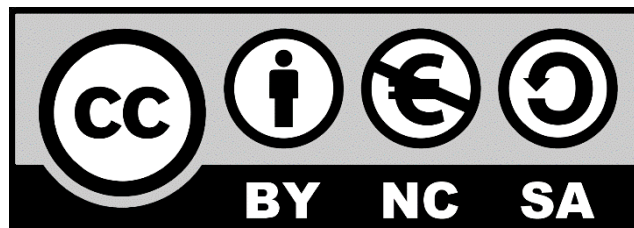
# Eco-Friendly Dyeing and Printing Techniques

# Sustainable Fashion Design

## Module 3: Eco-Friendly Dyeing and Printing Techniques

- **3.1** Environmental Benefits to Eco-Friendly Dyeing and Printing Techniques.
- **3.2** Natural Dyeing, Low Water Dyeing and Digital Printing.

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# OVERVIEW

- **Module 3** analyzes eco-friendly dyeing and printing techniques which have gained significant importance in the fashion and textile industry.
- Traditional dyeing and printing methods often involve the use of harmful chemicals, excessive water consumption, and the release of pollutants into water systems.
- This module will cover natural dyeing and printing techniques which utilize cleaner processes and focus on reducing water and chemical usage.



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## 3.1 Environmental Benefits of Eco-Friendly Dyeing and Printing Techniques

- Eco-friendly dyeing and printing techniques are important for creating a more sustainable fashion and textile industry.
- Fabric dyes and fabric dyeing techniques have a very high environmental impact.
- The use of harmful chemicals found in fabric dyes and fabric finishes, the large amount of energy used and the waste water produced has left a negative effect on the environment.
- Refer to Required Video: *Dyed Without Waste – Developing a Way to Save Water In the Textile Industry.*

# Environmental Benefits of Eco- Friendly Dyeing and Printing

Environmental Benefit	Action
Reduced Water Consumption	Eco-friendly dyeing techniques like <i>digital printing</i> and <i>low-water dyeing</i> significantly reduce water usage.
Decrease Chemical Usage	Eco-friendly methods use <i>non-toxic, natural dyes or water-based inks</i> , which minimize the release of harmful substances into the environment.
Decrease Energy Consumption	Many <i>eco-friendly dyeing processes</i> , are designed to operate at lower temperatures, reducing energy consumption.
Less Waste production	<i>Digital printing on demand</i> and <i>zero-waste dyeing</i> help to minimize fabric waste and dye overproduction. These methods allow for more precise application of dyes, reducing the excess.

<b>Biodegradability and Renewable Resources</b>	Natural dyes derived from plants, insects, or minerals are biodegradable. Using natural materials for dyeing also promotes sustainable farming and reduces reliance on fossil fuels.
<b>Improved Air Quality</b>	Eco-friendly alternatives, such as water-based inks and dyes, emit little to no volatile organic compounds , improving overall air quality.
<b>Non-Toxic for Workers and Consumers</b>	Eco-friendly processes reduce the risk to workers' health by using safer materials. Consumers also benefit from non-toxic products as they are safer to wear and use.
<b>Longer Durability of Fabrics</b>	Eco-friendly dyes may improve fabric quality as they don't weaken the fibers as much as synthetic dyes do. This increases the longevity of the product, reducing the need for frequent replacements.



## 3.2 Natural Dyes



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Natural dyes are now making a resurgence as part of a broader movement towards sustainability, eco-friendliness, and ethical fashion. Many designers such as Stella McCartney Eileen Fisher, and smaller artisanal brands are integrating natural dyes into their collections.

Refer to YouTube Video : *Eileen Fisher*



# Common Natural Dyes



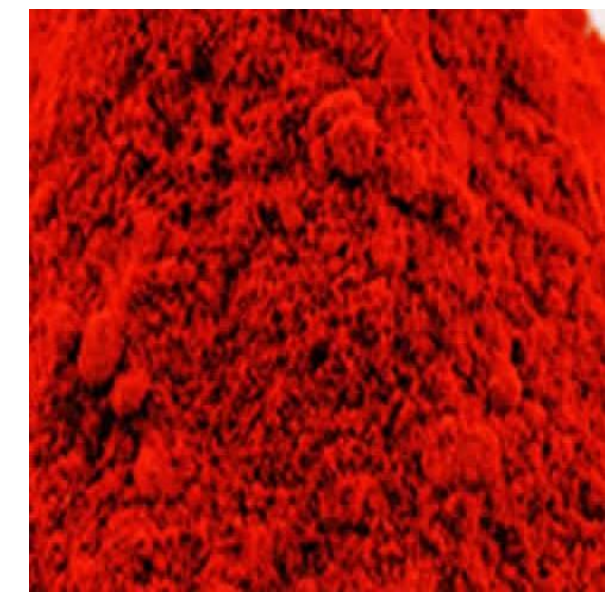
**Indigo** (from the Indigofera plant) for deep blues.



**Madder** (from the Rubia tinctorum plant) for red shades.



**Turmeric** (from the Curcuma longa plant) for yellow.



**Cochineal** (from insects) for pinks and reds.

Refer to You Tube video: *How Was it Made? Indigo Dyeing*



- Natural dyes are derived from natural sources such as plants, minerals, insects, and fungi.
- They are renewable, biodegradable resources and offer environmental and social benefits. This includes a low carbon footprint and valuable employment for rural communities.
- This has provided an important alternative in comparison to synthetic dyes, which are petrochemical-based and can harm the environment.

- Natural dyes are suitable for colouring natural fibers only, and in most cases no mordants/ fixing agents are required.
- Mordants range from heavy metals such as chromium and tin, to oak galls, yeast and urine.





In comparison to synthetic dyes, natural dyes have:

- A large variation of colour tones, due to the quality difference of the dye plant.
- They require longer and slower dyeing treatments to achieve good colour.
- The process is more costly.







# Dyeing Processes and Techniques

**Immersion Dyeing** is the process where fabric is dipped in a dye bath multiple times to achieve the desired color intensity.



## Batik and Shibori:

**Batik and Shibori** are resist-dyeing techniques that involve creating patterns by folding, binding, or applying wax to fabrics before dyeing.



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Photo By: Pat Kresty on Pinterest

# Eco-Printing:

**Eco-Printing** is a newer technique that uses actual leaves, flowers, and other plant materials to directly imprint onto fabrics, creating natural and unique designs.

Refer to YouTube Video: *How to make eco print on fabric | Tutorial*



# Low Water - Dyeing

- Low water dyeing is a technique used to minimize water usages offering a more environmentally friendly alternative to traditional dyeing processes.
- Conventional dyeing methods require up to 140 – 200 liters per kg of fiber, while low water dyeing techniques need only 1.5 – 2 liters per kg, making it a sustainable option for the fashion industry.

Other advantages to using Low-water dyeing are:

- **Cost-effective:** Less water and energy use can result in lower production costs.
- **Innovative Designs:** This method often leads to unique patterns and color effects, particularly in smaller batches, giving designers more creative control over the final product.



# Techniques and Variations:

- **Tie-dye and immersion methods** can use low water dyeing, controlling the water and dye usage.
- **Batch dyeing** techniques, such as using large zip lock bags or tubs, where the fabric and dye mixture are agitated with minimal water, are also popular for small-scale production.
- **Heat-set methods** are sometimes combined with low water dyeing, where fabrics are dyed with minimal water and then "set" with heat or steam, ensuring colorfastness without extensive rinsing.



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# Digital Printing

- Digital printing uses inkjets to propel tiny drops of dye or pigment on the fabric. In doing so it **reduces excess use of ink** and spillage.
- In digital printing **less water** is used as it is not required for dyeing or washing.
- Digital printing **produces vibrant high-resolution designs** with precision, making it a popular choice for designers such as Patagonia and Stella McCartney.
- This method is transforming fashion by allowing designers greater creative freedom, faster production, and more eco-friendly practices.

# Digital Printing Techniques in Fashion

- **Direct-to-Garment Printing** involves printing directly onto a finished garments, using specialized inkjet printers. It's often used for printing graphics or logos on clothing.
- **Roll-to-Roll Printing** a continuous roll of fabric is printed digitally before being cut and sewn into garments. Roll-to-roll printing is ideal for large-scale fabric production, especially for fashion brands that produce patterned fabrics in bulk.
- **Sublimation Printing** is used for polyester fabrics, sublimation printing involves transferring dyes from paper onto fabric using heat and pressure. This method produces vibrant, long-lasting prints with minimal fading or cracking.



# 3D Printing & Smart Textiles

## 3D Printing

- 3D printing is becoming a popular choice for fashion designers as it allows them to create intricate and more customized designs with minimal waste. This method of printing **uses recycled plastic and biodegradable polymers** minimizing our reliance on traditional fabrics, this reduces waste.
- Adidas and Iris Van Herpen are designers using 3D printing in their collections.

Refer to the case study: *How Adidas is leveraging 3D Printing in the Footwear Industry*





4D FWD 2M, a sports shoe where parts of it are 3D-printed.



# Smart Textiles

- Smart textiles are textiles embedded with sensors and electronic components. Their purpose is to regulate body temperature, monitor health metrics and even change colour.
- The idea behind smart textiles is to reduce the need for more clothing items hence promoting a more sustainable wardrobe.

Refer to the following reading:

- *Smart Textiles: The Next Frontier in Fashion Design*
- *Eco-Friendly Fashion: How Sustainable Clothing Printing is Changing the Industry*



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