



Comparative Analysis Of Eco Printing On Cotton And Silk Fabrics Using Pine Leaves With And Without Dye Blankets

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Abstract

This study explores the potential of Pinus (pine tree) leaves as a natural source for eco-printing on cotton and silk fabrics. The research compares two eco-printing techniques—printing with a dye blanket and without a blanket. The effects of mordant and blankets on color intensity, print definition, and fastness properties were observed. Results indicate that both techniques can produce aesthetically pleasing prints, with distinct variations in color depth and pattern clarity depending on the mordant or blanket used. This study highlights eco-printing as a sustainable and creative approach to textile surface design.

Keywords

Eco-printing, Pine leaves, Cotton, Silk, Mordants, Dye blanket, Natural dyes, Sustainable textiles

1. Introduction

Eco-printing is an innovative, eco-friendly textile surface design technique that utilizes natural plant materials to create direct prints on fabric, without the use of synthetic dyes or harsh chemicals. This method aligns with the growing demand for sustainable and slow fashion practices.

Pine tree (Pinus spp.) leaves, which are generally considered waste material, offer potential as a bio-resource for natural printing. Their tannin content can interact with mordants and dye blankets to yield a range of colors and patterns.

This research focuses on eco-printing of cotton and silk fabrics using pine leaves under two different methods:

- Printing without blanket using various mordants.
- Printing with a dye blanket (madder, sappanwood, and iron).

The aim is to evaluate the influence of these treatments on print clarity, color development, and overall aesthetic outcomes.

2. Materials and Methods

2.1 Materials

- Fabrics: 100% cotton (plain weave) and 100% silk (plain weave)
- Plant material: Fresh pine leaves were collected from nearby areas of Prayagraj Uttar Pradesh.

Mordant :

- Alum (Aluminum potassium sulphate)

Blanket (for with-blanket method):

- Madder (Rubia cordifolia root powder)

2.2 Pre-treatment of Fabric

The cotton and silk fabrics were first subjected to a scouring process to remove any surface impurities, sizing agents, oils, or finishes that might interfere with dye or mordant absorption. Scouring was carried out by boiling the fabrics in a solution containing 5 g/L of non-ionic detergent and 2 g/L of soda ash (sodium carbonate) for 1 hour, followed by thorough rinsing in warm water and drying in shade.

After scouring, the fabrics were mordanted according to standard natural dyeing protocols. For cotton (a cellulose-based fabric), separate mordanting baths were prepared using alum (10% w/v). The cotton samples were soaked in the respective mordant solutions at 90°C for 60 minutes, stirred occasionally to ensure even treatment, then allowed to cool in the bath before rinsing and drying.

For silk (a protein-based fabric), mordanting was done using the same mordants but at a lower temperature of around 70°C to prevent fiber damage. The silk samples were soaked in the respective mordant solutions for 45 minutes, then gently rinsed and air-dried in shade. The pre-mordanted fabrics were then used for the eco-printing experiments under both blanket and non-blanket techniques.

In the **without blanket method**, the scoured cotton and silk fabrics were mordanted using alum (10% w/v). The cotton samples were immersed in the respective mordant baths and heated to approximately 90°C for one hour with occasional stirring to ensure uniform absorption. Silk fabrics, being proteinaceous and more sensitive to high temperatures, were mordanted at 70°C for 45 minutes to prevent fiber damage. After mordanting, the fabrics were allowed to cool in the bath, then thoroughly rinsed in cold water and dried in shade before printing.

In the **with blanket method**, all fabric samples—both cotton and silk—were pre-mordanted exclusively with alum at a concentration of 10% w/v. The same temperature and time parameters were followed as described above for cotton and silk. Once mordanted, the fabrics were dried in shade and used for eco-printing with an added dye blanket layer, consisting of madder dyed material.

2.3 Eco-printing Process

2.3.1 Without Blanket Method

- Alum mordanted fabric was laid flat.
- Pine leaves were arranged on the surface.
- The fabric was tightly rolled and tied.
- Bundles were steamed for 90 minutes.
- After cooling, bundles were opened and fabrics were washed and dried.

2.3.2 With Blanket Method

- Pine leaves were arranged on pre-mordanted fabric.
- A dye blanket (madder, sappanwood, or iron blanket) was placed on top.
- The layered assembly was rolled, tied, and steamed as above.
- Fabrics were then processed as in the previous method.

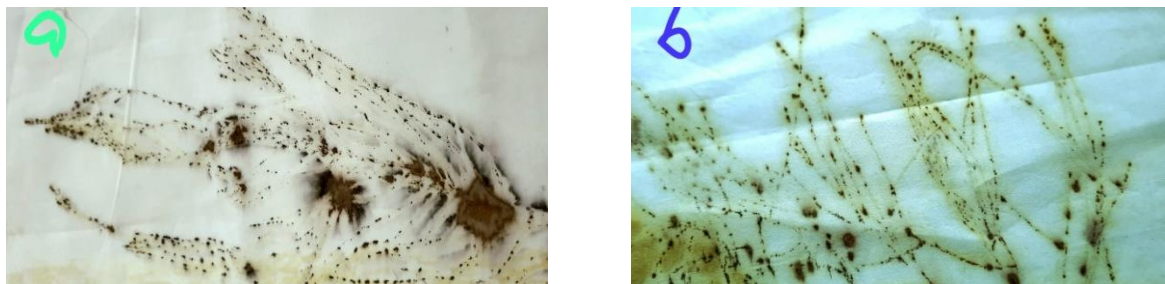
2.4 Evaluation of Prints

- Visual assessment of color and pattern development.
- Comparison of print clarity and definition.
- Color fastness tests (wash and light fastness) according to standard methods.

3. Results and Discussion

3.1 Without Blanket Method

Alum: Produced soft yellow to light brown prints; good pattern clarity on silk, moderate on cotton.



Alum Mordanted silk without blanket

Alum Mordanted cotton without blanket

3.2 With Blanket Method

Madder Blanket: Produced vibrant pink to reddish prints; excellent clarity on silk, softer on cotton.



Alum mordanted silk with Madder blanket

Alum mordanted cotton with Madder blanket

3.3 Comparative Analysis

Parameter	Without Blanket	With Blanket
Print Clarity	Moderate to Good	Very High
Color Vibrancy	Subtle to Moderate	High
Pattern Definition	Good	Excellent with iron blanket

Parameter	Without Blanket	With Blanket
Fastness	Variable, mordant-dependent	Generally improved with blanket

3.4 Observations

The use of dye blankets resulted in deeper, richer tones and more defined prints. Mordanting alone could achieve decent prints, but results were lighter and more subtle. Silk fabrics consistently showed better uptake and clarity compared to cotton, likely due to their protein-based structure. Pine leaves proved to be a versatile printing source, responding well to both approaches.

4. Conclusion

This research demonstrates the viability of eco-printing with pine leaves on cotton and silk fabrics. Both the with-blanket and without-blanket methods produced unique and aesthetically pleasing results. While the without-blanket approach offers a more subtle and natural look, using a dye blanket significantly enhances color depth and print definition.

Eco-printing, as a sustainable technique, holds great potential for artisanal and niche textile markets. The findings suggest that combining natural mordants and dye blankets can further diversify design possibilities.

5. References

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