



(RESEARCH ARTICLE)



## Recycling floral waste from temple using different techniques of eco-printing on cotton fabric

Meena Batham \* and Sonali Mandhary

*Institute of Home Economics, University of Delhi, India.*

International Journal of Science and Research Archive, 2023, 09(01), 118–125

Publication history: Received on 26 March 2023; revised on 03 May 2023; accepted on 06 May 2023

Article DOI: <https://doi.org/10.30574/ijrsra.2023.9.1.0351>

### Abstract

Today's generation is becoming more environmentally conscious and shifting towards sustainable fashion. Unfortunately, synthetic dye is being dominantly used as they produce bright color and are cheap but are hazardous to health and as compared synthetic dye natural dye are chemical free, biodegradable and eco-friendly. Role of natural dye has been increased as preservation of traditional heritage is also one of the important sustainable development goals to which every country is trying to abide. Natural dyes are considered for their endurance and soft lustrous coloring. This research work focused on the extraction of natural dye by recycling floral waste from temples by using different techniques of Eco-printing on cotton fabric. Marigold and rose flowers were commonly used in India for worship. Pre-mordanting method was used for dyeing purposes, in which fabric was first mordant then used for printing. Commercially available tea powder (5gram) was used as Natural source of mordant. Further samples were tested on the basis of wash fastness and rub fastness properties. It was found that samples exhibit good wash and rub fastness.

**Keywords:** Eco printing; Natural Printing; Sustainable Printing; Cotton fabric

### 1 Introduction

Nowadays, Consumers are aware about environmental regulation worldwide and are getting more interested in buying eco-friendly products. Textile industry has numerous challenges regarding fulfilling consumer's demand for providing 'Environmentally Improved Textile Product (EITP)' because such products also have great demand in the export market [3].

As we know that in the 21<sup>st</sup> century climate change, global warming, increased waste production is increasing at a very fast pace which becomes the issue of concern in the globalized field of research, a trend that seeks immediate attention. For example, waste from temple, domestic, organic and agricultural waste such as peel from vegetable, flowers trimming, rotten fruits etc are all biodegradable, so if not managed properly it can cause water and land pollution through its nutrient leaching and decomposition, therefore some steps should be taken to avoid such activities that could harm environment. With proper handling over such waste could provide as resource materials for range of processes in industries like biochar from agricultural waste, colour extract from domestic and temple waste. This waste could serve as a source for the extraction of natural dye textile-dyeing operations.[5]

In spite of the fact that India had a rich heritage of using natural resources for dyeing and printing but influx of synthetic dyes drove the natural dye into oblivion. But due to carcinogenic effects of synthetic dyes, green-minded consumers are back to natural dye as these are non-hazardous, biodegradable and have better compatibility with the environment. Natural dyes are colouring pigment that are obtained from the nature such as plants (indigo, madder), Insect (Cochineal beetles and lac scale insects) Animals (red mouthed rock shell and Levantine Sea snails) vegetables and minerals in form of colored clays and earth oxide (manganese oxide, iron) [1].

\* Corresponding author: Meena Batham

### *Significance of the study*

Unfortunately the fashion industry uses many chemical and synthetic dye that have social and environmental impact, textile industries dominantly use synthetic dye as they are cheap and produce bright shades but are hazardous to human health, in order to reduce the impact on the environment, old eco- practices are now being reassessed.

As we all are aware that the natural elements like flower are eco- friendly, biodegradable and non-toxic in nature which makes them exceedingly popular among nature loving and health awarded people. The key to creating a long -term sustainable fashion industry, reducing waste and unnecessary damage to the environment i.e. eco-printing, eco-dyeing. So natural elements should be used to protect the environment.

Eco- printing is a kind of art for creating visual effects through natural colorants existing in plants, flowers, insects, fruits, vegetable by products etc. natural colorant from these materials transferred to paper or fabric via boiling, steaming and hammering. It allows designers and artists to present their imaginations unrestrictedly, unpredictable results, patterns, colour and visual effects are possible. Since flowers are obtained from nature and contain natural biodegradable colouring agents, these could be grouped as natural dyes and suitable for eco printing.

### *Importance of eco-printing*

- Create conscious and sustainable clothing.
- Create unique pieces through flowers, plants, insects etc shade and colour intensity.
- Promote healthy and safe conditions for workers and the environment.
- Can be used to give new life to old clothes
- Recover waste
- Eliminate the risk of contamination by chemicals (in water, soil etc.)

### *Objective of the study*

The main objectives of the study are: -

- To extract tannic acid from commercially available tea leaves and pre mordant the cotton fabric with it.
- To collect temple floral waste and apply them on pre-mordanted cotton fabric using different techniques of eco printing.
- To analyse and compare the fastness properties of eco printed samples.

---

## **2 Material and method**

Keeping in mind the objective of the study, a plan of work was formed to carry out the study and collect the necessary data.

The whole study was conducted in three phases:

- **Phase I** - Extraction of tannic acid from commercially available tea leaves and pre mordant the cotton fabric with it.
- **Phase II** - Collection of floral waste from temple and apply them on cotton fabric using different techniques of eco printing.
- **Phase III** - To analyze and compare the fastness properties of eco printed samples.

### **2.1 Phase I**

Extraction of tannic acid from commercially available tea leaves and pre mordant the cotton fabric with it.

#### *2.1.1 Extraction of tannin*

Commercially available tea was used as a natural mordant for extraction of tannin. Extraction of tannin was made using a hot aqueous method. 5g of tea powder were boiled with 200 ml water for 1 hour followed by filtering through a fine muslin cloth after cooling and the remaining residue followed the same process 3 times to complete the extraction. The final extract was boiled and stood overnight and then filtered again.

### 2.1.2 Scouring (cooking)

Scouring is done to remove the oil, grease, wax, dirt from the fabric attached on the surface. so that the absorption of dyes on the fabric can take place easily. Fabric was washed in a detergent solution water and kept in it for 30 minutes and rinsed off in running water.



**Figure 1** Fabric Scouring

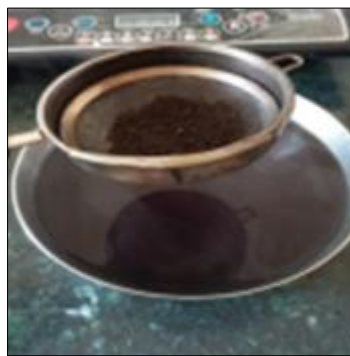
### 2.1.3 Mordanting of fabric

Fabric sample was treated with a mordant solution prepared from tea powder, mordanting plays an important role in preparing fabric so that it can dyes well.

**Pre-mordanting** technique was used in this study :- Substance is treated with the mordant and then dyed. Cotton (cambric) cloth of 20 x 20 cm was treated with 5g of tannin solution in 200 ml water for 45 minutes, keeping temperature (between 60 ° -70 ° C). Squeezed properly and ready to dye.



Tea Powder



Mordant solution



Pre-mordant Fabric

**Figure 2-** Stages of mordanting fabric with tea leaves

## 2.2 PHASE II

Collection of floral waste from temple and apply them on cotton fabric using different techniques of eco printing.

### 2.2.1 Collection of flower from temples

Marigold and rose flowers were collected from the nearer temple for their easy availability.

### 2.2.2 Application of dye (flower) using different eco printing techniques

Eco-printing is a historic technique where plants, leaves and flowers leave their shapes, color, and marks on fabric. Material bundled inside of cloth is steamed and hammered to release the dye found naturally inside the plant, creating a contact print in the shape of the leaf or flower used.

These contact prints are referred to as "eco prints." With eco printing, not only the color but the shape and many times, quite a bit of detail of the leaves or flowers is used itself, printed onto the fabric or paper.

### 2.2.2.1 Steaming technique (Figure -3)

- Place the flowers onto the fabric in a desired pattern and cover the fabric with plastic and fold it.
- To hold the position so that it is not loosened, wrap a thread or rope along the outside of the fabric roll and tie it tightly.
- Insert a roll of cloth into the steamer, then steam (maximum 180 ° F/ 80 ° C) for two hours to move the natural pattern of the flowers to the fabric so that the pigment contained in the flowers is extracted perfectly and fix on fabric.
- After steaming for two hours, then remove the cloth roll from the steamer then let the sample stand for a few moments to cool down.
- Finally untie the fabric.



Step 1. Placement of flower on cotton fabric



Step 2. Folding of fabric with flower



Step 3. Tying of fabric with thread



Step 4. Steaming of folded samples

**Figure 3** Steps involved in steaming technique

### Hammering technique (Figure 4)

- Place the flowers onto the fabric and fold it over with a second piece of fabric
- Take the hammer and start taping the fabric, you'll need to hit every bit of the flowers.
- Check the progress by peeling back the flowers from the fabric to reveal the print.



**Figure 4** Hammering technique

### 2.3 Phase III

To analyze and compare the effects of eco printing techniques used in terms of wash fastness and rub fastness properties.

#### 2.3.1 Color fastness

Color fastness is the property which determines the endurance of a change in any of its color characteristics, to transfer of its adjustment material, or both, due to which the material might be exposed to during processing, testing, storage, or use. The fastness of a dye is related to its chemical nature, proper application, and its depth of shades. Assessment of fastness involves visual determination of either change in shade or staining of an adjacent material.

Samples were tested for wash fastness and rub fastness.

#### 2.3.2 Wash fastness

The loss of color during laundering is referred to as the lack of wash fastness or 'bleeding'. Wash fastness of any material is the resistance of a material to the change in color, change in surface or staining of the adjacent surface during laundering.

A launderometer is a laundering machinery for rotating closed canisters in a thermostatically controlled water bath.

Specimens were tested in 5g/l soap at 60 c for 45 minutes in 1:50 material liquor ratio in the launderometer.

- Adjust the launderometer to require temperature.
- Pour the liquor into each canister according to the MLR.
- Enter the specimen sandwich assembly into these canister
- Fasten the canister onto the rotor of the laundrometer.
- Start the rotor and run it for the prescribed time period.
- Stop the machine and unclamp the cover of the canister to take out the sample.
- After the treatment, the samples were rinsed in cold running water for 10 minutes, squeezed and dry in air.
- Change in color of printed sample and staining of adjacent portions of the fabric were assessed by gray scale from 1-10.

Indicates poor and 5- indicate excellent fastness to washing.

**Table 1** Test condition for wash fastness

Test	Reagent	MLR	Time	Temperature
ISO II	5% soap solution	50:1	45 min	50+2 -

## 2.4 Rub Fastness/Crock Fastness

Crocking is the transfer of colorant from the surface of coloured yarn or fabric to another surface or to an adjacent area of the same fabric principally by rubbing /crock fastness or rub fastness refer to the ability of a dyed specimen to resist any change in color that may be brought about by the action of rubbing crock fastness is a color fastness property of great concern.

## 3 Result and discussion

In the present study, two different techniques of eco printing were used and their results were analysed in terms of their fastness properties.

Steaming and hammering techniques were the two techniques used in this study. Marigold and rose were the flowers used which were commonly used in temples and normally dumped after first offering to idol of god.

Pre-mordanting method was used on cotton fabric (cambric). Then printing was done. Printed samples were tested for color fastness including wash fastness and rub fastness.

### 3.1 Wash fastness

Wash fastness of cotton (cambric) eco-printed samples was assessed using ISO standard test no.2. specimen were treated in 5 g/l soap at 60°C.

**Table 2** Result of wash fastness test on cotton fabric

Fabric	Without mordant		With mordant	
	Color change	Staining	Color change	Staining
Steaming	2/2	3/4	4/4	4/4
Hammering	2/3	2/2	4/4	4/4

Results show that wash fastness for mordanted samples is good as compared to unmordanted samples. It means by application of mordant, dye can easily penetrate into fabric and be fixed for a long time, therefore results in good fastness property.

On comparing techniques, hammering techniques gives better results than steaming techniques. Reason could be, on steaming, water molecules present in steam, hindered the dye uptake and fixation process. whereas, in hammering, dye gets directly absorbed onto the surface of fabric and hence results in good fastness.

#### 3.1.1 Rub fastness (dry)

**Table 3** Result of Rub fastness test on cotton fabric

Fabric	Without mordant		With mordant	
	Color change	Staining	Color change	Staining
Steaming	2/2	3/4	4/4	4/4
Hammering	2/3	3/4	4/4	4/4

Results show that rub fastness for mordanted samples is better as compared to unmordanted samples.

On comparing techniques, hammering techniques again gives better results than steaming techniques, with grey scale reading of 4/4.

### 3.1.2 Rub fastness (wet)

**Table 4** Result of rub fastness (wet) test on cotton fabric

Fabric	Without mordant		With mordant	
	Color change	Staining	Color change	Staining
Steaming	2/2	2/2	3/4	3/4
Hammering	3/4	3/4	3/4	3/4

Results show that rub fastness (wet) for mordanted samples is good as compared to unmordanted samples with grey scale reading of 3/4.

On comparing techniques, hammering techniques again gives better results than steaming techniques with grey scale reading of 3/4.

## 4 Conclusion

Temple floral waste could be efficiently recycled and utilized in diverse sectors, ranging from agriculture to dye industries and in wastewater treatment application. Flowers make our life colourful and play a significant role expressing our emotions. but once they have served their purpose flowers are generally thrown off. investigators wanted to exploit the use of such flowers in dyeing and printing of cotton fabric.

Commercially available tea leaves was used as mordant and pre mordanting method was used for the study in which cotton fabric was first treated with 5g of tea powder solution for 45 minutes. Then for the further study was carried out by applying different eco printing techniques (steaming and hammering) and each technique gives unique results. These tests were analyzed on the basis of rub fastness and wash fastness.

Results show that the colour fastness for mordanted samples was good as compared to unmordanted samples. It means by application of mordant, dye can easily penetrate into fabric and be fixed for a long time, therefore results in good fastness property.

On comparing techniques, hammering techniques gives better results than steaming techniques. Reason could be, on steaming, water molecules present in steam, hindered the dye uptake and fixation process. whereas, in hammering, dye gets directly absorbed onto the surface of fabric and hence results in good fastness.

## Compliance with ethical standards

### Acknowledgments

I would like to thank Dr. (Mrs) Geeta Trilok – Kumar, Director of Institute of Home Economics under whose patronage the study was conducted.

I take this opportunity to give my thanks to the laboratory staff of the Dyeing and Printing department, especially Mr. Bali Ram for his kind support and help.

### Disclosure of conflict of interest

No conflict of interest.

## References

- [1] Agarwal, R., Pruthi, N., & Singh, S. j. . Effects of mordant on Printing with marigold flowers dye. Natural Product Radiance , 6 (4), 306-309, 2007

- [2] Das, A. K., Islam, et al., Review on tannin: Extraction process, applications and possibilities. *South African Journal of Botany*, 135, 58-70, 2020.
- [3] M. S., Gunjal, et al., Management of floral waste by conversion to value-Added Products and Their Other Applications. *Waste and Biomass Valorization*, 33-43, 2017.
- [4] P. M., & Ambre, M. P. , Development of Compound Shades of Indigo and Marigold using Natural Mordant on Cotton and Cotton/Viscose Blend. *Textile Association*, 78 (1), 15-20, 2017.
- [5] Singh, p., bor thakur, A., singh, R., Awasthi, S., Pal, D., Shrivastava, P., et al., Utilization of temple floral waste for extraction of valuable products: A close loop approach towards environmental sustainability and waste management. *Pollution*, 3 (1), 39-45, 2017.
- [6] Win, K. H., Naing, H. H., & Khaing, Y. k. Extraction of Tannin as a Natural Mordant from Tea Leaf for Dyeing of Cotton Cloth. *University of Mandalay, Research Journal*, 11, 48-55, 2020.