

Natural Plant Based Dyeing of Cotton Material

Mr. S. Natarajan¹ R.S. Taruna² K. Thilaak³ S. Surya Prakash⁴

¹Assistant Professor ^{2,3,4}UG Student

^{1,2,3,4}Department of Textile Technology

^{1,2,3,4}Kumaraguru College of Technology, Coimbatore, India

Abstract — In present scenario environmental focus of human beings approximately natural products, renewable nature of substances, much less environmental damage and sustainability of the natural merchandise has further revived the usage of herbal dyes in dyeing of fabric materials. Natural dyes are having some inherent advantages fabric-based handicraft industries in many countries engaged local humans to dye textile yarn with herbal dyes and weave them to produce strong point fabrics Turkish carpets are known for their beauty made with herbal dyes. The main importers of natural dyes are the United States and the EUT. The synthetic chemical dye reasons many unfavorable effects on the skin and additionally environmental unfriendly considering, herbal loss of life strategies used by the humans wishes revival, therefore this have a look at become undertaken and was targeted on death homes of plants of *Peltophorum pterocarpum* *Mentha piperita* *L.Crossandra infundibuliformis*.

Keywords: Natural Dye, Dye Extraction

I. INTRODUCTION

Even though they have been at the cutting edge of both technological and aesthetic progress, textiles have always played a crucial part in the development of human culture. Textiles' inherent ability to protect has paved the way for creative inventions. Everyone should have some knowledge of textiles because they have such a significant impact on how we live our daily lives. People have used textiles of many kinds from the dawn of time for warmth, personal decoration, covering, and even as a means of displaying wealth. Textiles are still used for these things now, and everyone is a consumer in the end. A wide range of textile items treated with antimicrobial characteristics are required and expected as customers' awareness of the importance of living hygienically grows.

"Consumers are looking for a solution to the odour and microbiological problem as well as the special advantages offered by antimicrobial finish. The term "textile finishing" refers to a very broad variety of processes that are applied to textiles before they are delivered to the final consumer. It is well known that several natural colours made from different plants contain antibacterial characteristics. The manufacture of potentially hazardous dyes has recently been stopped, which has led to a decrease in the toxic effluents produced by the textile dye industry. The non-toxic, biodegradable, and non-carcinogenic properties of natural colours obtained from flora make them harmless. They are a more ecologically friendly solution because they do not contribute to pollution or wastewater issues. For the purpose of extracting colour for use in the textile industry, several plant and animal/insect sources have been identified.

There are over 500 different plant species in India that may produce natural colours. These days, skin allergies brought on by clothes are more prevalent. The use of non-

ecological colours on textiles is one of the primary causes of this. The European Community has consequently prohibited specific azo dyes that give textiles their light hue. Natural dyes have had a worldwide resurgence as a result. India, historically known for creating textiles that were coloured and printed using natural dyes, is attempting to reclaim its lusture.

A. Advantages of natural dyeing.

There are some inherent advantages in using natural dyes.

- No health hazard
- Easy extraction and purification
- No effluent generation
- Very high sustainability
- Mild dyeing conditions
- Renewable sources

B. Disadvantages of natural dyeing

Natural dyes also have some disadvantages based on their applications:

- They are mostly applicable only to natural fibres (cotton, linen, wool and silk)
- Poor colour fastness properties
- Poor reproducibility of shades
- No standard methods and color recipes available.
- Metallic mordants are used, some of which are not eco-friendly.

C. Classification of natural dyes.

Based on origin/source the natural dyes are classified into several groups, which are given below:

- Vegetable origin
- Animal origin
- Mineral origin

For vegetable origin of natural dyes, the different parts of plants and trees are the best source of natural dyes. The natural dyes are mostly extracted from different parts of plants and trees. Several parts of plants/trees are used in the extraction of natural dyes and pigments, they are:

- Seed
- Root
- Stem
- Barks
- Leaves
- Flowers

II. NATURAL DYEING MATERIALS

Here are few important natural dyes which are widely used in the dyeing of textile materials, described below.

A. Jack fruits (*Artocarpus heterophyllus* Lam)

It is a very popular fruit in some parts of India mainly in the southern parts of India. It belongs to the family of Moraceae. The wood of the tree is cut into small chips and crushed into

dust powder and then the crushed wood powder is boiled in water to extract dye substance. Yellow to brown shades are obtained after the mordanting treatment of dyed fabrics. The cotton and jute fabrics are dyed by this dye.

B. *Curcuma longa* (turmeric)

The ground plant roots used to make the turmeric that may be found on shelves and in spice cupboards. Many cultures have used processed turmeric as a dye because of its vivid yellow hue. In addition to being a tasty and healthy spice, turmeric has long been used in Indian and Ayurvedic medicine to treat liver problems, wounds, digestive problems, and inflammatory illnesses

C. *Mint*

A hybrid herbaceous plant called *Mentha piperita* was created by combining water mint (*Mentha piperita*) with spearmint (*Mentha spicata*) (*Mentha aquatica*). Infusions, tinctures, teas, extracts, and essential oils made from peppermint leaves are used all throughout the world, but are particularly popular in western and Middle Eastern nations. Anesthetic, antibacterial, antifungal, antihelmintic, and antioxidant activity are some of its pharmacological qualities.

D. *Crossandra infundibuliformis*

Crossandra infundibuliformis is called as the firecracker flower, it is a species of flowering plant in the family Acanthaceae, native to southern India and Sri Lanka. *Crossandra infundibuliformis* can mostly be found in the southern Indian region Malenadu and Kerala. Other uses of Firecracker flower are ornamental, hanging, border, hedging, ground cover, container, greenhouse.

E. *Onion* (*Allium cepa*)

To extract dye substance from onion, its papery skin is the main source. Papery skin of the onion is boiled in the water to extract the colour and subsequently can be dyed with or without mordanting the fabric. Orange to brown are the resulting colors obtained from the onion skin. Pelargonidin is the coloring pigment found in onion skin. (5,5,7,4 tetrahydroxy antocyanidin). The amount of coloring pigment present varies from 2.0 to 2.25%

F. *Peltophorum pterocarpum*

Peltophorum pterocarpum is an attractive tree known for its beautiful yellow blossoms. Fodder is made from *Peltophorum pterocarpum*. The tannins in the bark can be used as dyes, giving leather a bright yellow hue. Wood and leaves both contain tannin.

G. *Henna* (*Lawsonia inermis* L)

The leaf of the plant which is traditionally used in making of the coloured design by the hands of women is known as henna. It is dried, crushed and boiled with water to extract the dye from leaf. The fabric gives colour from brown to mustard yellow. This is the dispersed dye type colour where polyester and nylon can be dyed by henna. However, it gives lighter brown colour stains in wool and silk. Henna is commonly known as lawson. The chief constituent of henna leaves is a hennotannic acid; which is a red orange pigment. Chemically hennotannic acid is 2-hydroxy-1,4-

naphthoquinone. The coloring molecules have a strong substantivity for protein fibre.

H. *Saffron*

The dye which is extracted from the stigma of the flower, it is boiled in water, and then the colour is extracted. It gives a bright yellow colour to the textile fabric. The wool, silk and cotton can be dyed with saffron. Alum mordant substance which produces orange yellow shade, it is also called saffron yellow. This is also used as food coloring. Saffron is a perennial plant and it belongs to the Iridaceae family. The aqueous extract of saffron petals contains 12% colourant. The coloring matter of saffron contains phenolic compounds, flavonoids and anthocyanins. Anthocyanidins (pelargonidin) contained in saffron petals is responsible for the colour obtained. The oxidation of anthocyanidins produces the flavonol substance.

III. NATURAL DYEING

There are several organic components that may be combined to create natural dyes for tasks involving the coloring of cotton, silk, linen, and other types of cloth. The plant, fruit, or flower that you select, and the subsequent process will affect the shade and saturation level of the dye. The pH levels of colours may also be changed, and we'll discuss how to accomplish so in the section after this one.

A. *Bale dyeing*

One of the cheap ways to colour cotton fabric is bale dyeing. The cloth is put through a cold water bath where the sized warp has an affinity for the dye without being scoured or singulated. This kind of dyeing is frequently used on imitation linen and related materials.

B. *Cone dyeing*

For dyeing yarns for woven or knitted fabrics, it is utilized. The yarn is twisted all the way to the core bobbin before dyeing, then soaping and fixing in the same manner as scouring and bleaching.

C. *Fabric dyeing*

Dyeing of woven, knitted fabric using natural elements in water bath and the dye stuff is added this type of fabric dyeing is mostly used in industry

IV. METHODOLOGY

A. *Preparation of dye material.*

- The collect raw materials of the *Peltophorum pterocarpum*, *Mentha piperita*, *L. Crossandra infundibuliformis*, Onion, henna, turmeric and saffron.
- To dry the leaves, flowers and woods in indoor place (10 to 15 days) (shade dry)
- To grind the dried material like powder form for traditional dyeing it does not require dried powder

B. *Extraction of essence from natural materials.*

1) *Extraction of dye using traditional method*

We have taken that the 80 grams of mint during this traditional extraction and the M:L ratio is 1:30 boiling the

mint and adding the cotton fabric leave it for 30 min and then the fabric is dried



Fig. 1:

2) *Extraction of dye using Soxhlet apparatus*

Solid matrix is placed in SOX thimble. Solvent is heated under reflux. Condensation and extraction with “fresh” solvent. The Soxhlet extraction process heats the solvent (ethanol) to boiling temperature (>78°C). Solutes are transferred from the extraction chamber into the reservoir. Continuous repetition of the extraction. Up to 24 cycles are done By using the solvent (ethanol) the dye is extracted. Exhaustive extraction is complete

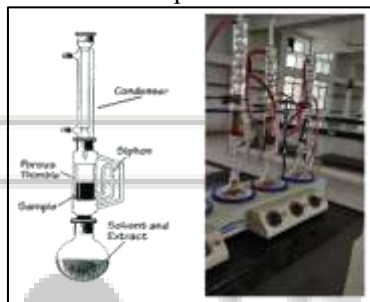


Fig. 2:

3) *Extraction of dye using ultrasonic extractor*

Maintain the bath at 45 – 50 degree Celsius with ultrasonic wave of 40 Hz. The material liquor ratio is 1:20. The dye is extracted by passing ultrasonic wave for 30 min. This method has good extraction compared to Soxhlet apparatus and Ultrasonic needs less time to extract the dye.



Fig. 3:

C. *Dyeing of Natural Materials*

The cotton fabric was weighted and put it in hot water to remove the excess amount of wax then squeezed Dyeing of natural materials using water bath

Temp: 70 -80 degree Celsius

Time: 30 min

M: L – 1:20

PH: 7-8

Total Amount of liquid = M: L * weight of the fabric
= 20* 4.58
= 91.6 ml

NaOH(10%) = 10/100 *91.6

= 9.16 g
Alum (5%) = 5/100*91.6
= 4.58 g

If dye from stock solution (dye – 10%) =10/100*4.58*100
=45.8 ml

Water = 91.6 - 45.8 = 45.8ml

The fabric is dyed with different types of mordant like alum, copper sulphate, ferrous sulphate, potassium dichromate, nickel sulphate

V. RESULT AND DISCUSSION

A. *Jack wood dyed fabric*



Alum.



Slaked lime



Copper II sulphate

Type of mordants	Light fastness	Water fastness	Rubbing fastness dry	Rubbing fastness Wet
Alum	4	4-5	4	3
lime	4	4-5	4	4
Copper II sulphate	4	4-5	4	3

B. *Turmeric dyed fabric*



Lime.



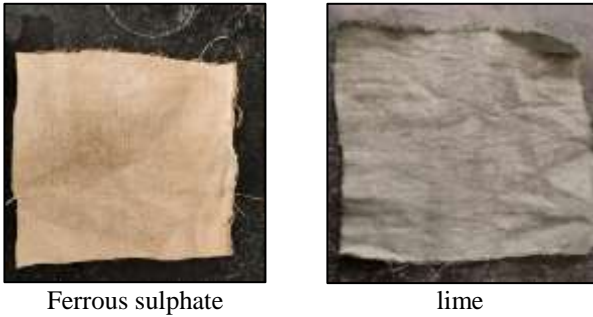
Copper sulphate



Ferrous sulphate

Type of mordants	Light fastness	Water fastness	Rubbing fastness dry	Rubbing fastness Wet
Lime	2	2-3	4	2
Ferrous sulphate	3	2-3	4	3
Copper II sulphate	4	3-4	4	3

C. Mint dyed fabric.



Ferrous sulphate

lime

D. Crossandra infundibuliformis dyed fabric



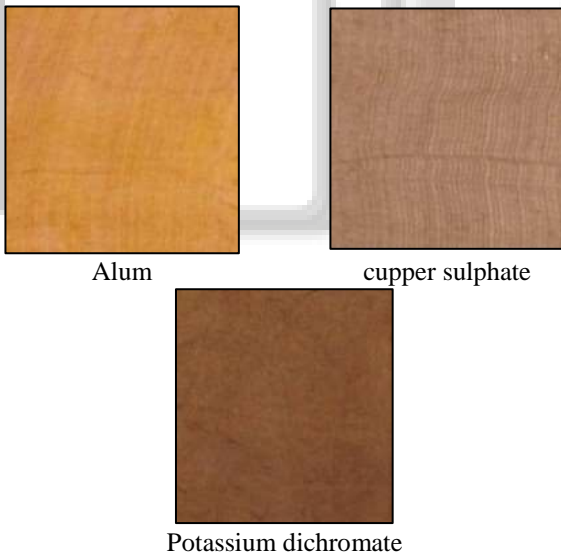
Copper sulphat

Alum



Ferrous sulphate

E. Onion dyes fabric



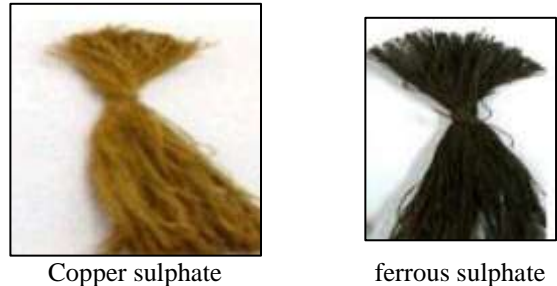
Alum

copper sulphate

Potassium dichromate

Type of mordants	Light fastness	Water fastness	Rubbing fastness dry	Rubbing fastness Wet
Alum	4-5	4-5	4-5	4-5
K ₂ Cr ₂ O ₂	4-5	4-5	4-5	4
Copper sulphate	4-5	4-5	4-5	4-5

F. Peltophorum pterocarpum



Copper sulphate

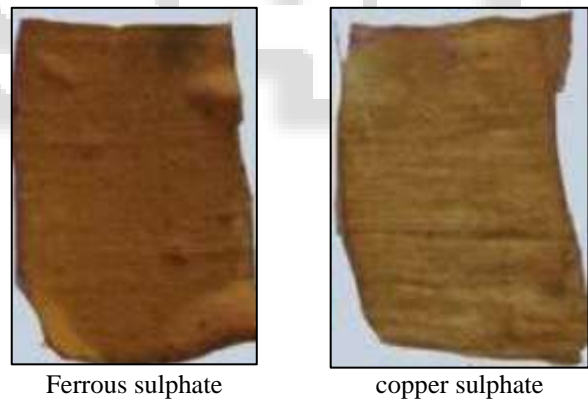
ferrous sulphate



Lime

Type of mordants	Light fastness	Water fastness	Rubbing fastness dry	Rubbing fastness Wet
Lime	2	3-4	4	2
Ferrous sulphate	4	3	4	3
Copper II sulphate	3-4	3-4	4	3

G. Henna dyed fabric



Ferrous sulphate

copper sulphate

VI. CONCLUSION

- It Is Found That the Flavonoids Group Is Not Present In The Crossandra Infundibuliformis,so the fabric not colored properly and by using the mordant for crossandra infundibuliformis it is also not colored that much compared to other natural materials. • The Peltophorum pterocarpum flowers gives good color and its rubbing fastness and color fastness good with CuSO4 and Feso4 mordant. • It is found that turmeric has good rubbing fastness fastness. • By using the natural dye food colors like turmeric dye in textile field we must switch on to Peltophorum pterocarpum because it is non-harming ,anti-microbial activity and Anti-oxidant activity in nature. • There are lot of resource like this peltophorum pterocarpum. Instead of using turmeric use peltophorum pterocarpum.

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