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# "An Eco-Friendly Natural Dying On Silk Fabric By Using Asian Fruits "*Ficus Carica*"

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**Abstract: Aim of the present study was to determine the best dyeing conditions on silkfabric for selected plants Asian fruit "Ficus Carica" . Present research is an attempt to explore colouring behavior on Silk fabric. The results of the study show that herb show good affinity for silk . Mordanting of the fabric was carried out using three mordanting technique i.e. pre, meta and post-mordanting using natural as well as chemical mordants i.e. goose berry powder, harda powder, orange peel extract, alum, ferrous and copper sulfate. Dyed samples were further analyzed for colour fastness properties with moderate to excellent fastness properties. To achieve the goal, some experiments were carried out with different dyeing conditions.**

**Keywords: Asian fruits *Ficus carica* , natural dye, mordant, colour fastness.**

## 1. INTRODUCTION

**Asian fruits ficus carica** is natural medicinal herbs found in abundance in various tropical and sub-tropical regions of India. These herbs have excellent curing and healing property and have been used as diseases curing medicines since Vedic era but no literature has been found regarding their colouring behaviour to textiles. These plants are named by different names in different parts of our country and abroad. Present research is an attempt to explore their colouring behaviour to textiles. [1,6] In this present research work, silk fabric was dyed after dye extraction from the **Asian fruits ficus carica** using aqueous extraction method and optimisation of dyeing condition like concentration of dye and mordants, time, temperature and pH value. Dyeing was carried out in water shaker bath by pre, meta and post-mordanting dyeing procedures using alum, ferrous sulphide and copper as chemical mordants and orange peel extract, goose berry extract and harda as natural mordants [2]. Various fastness properties of dyed fabric were evaluated using ASTM and AATCC test standards [3,6].

## 2. MATERIAL AND METHOD

### Material

**a) Fruit collection: -** ***F. carica*** fruits were collected from, Farm of Gohana ,Sonepat, Haryana.
**b) Silk fabric: -** 100% Silk fabric was procured from Nehru Place market of delhi(India).
**c) Mordants: -** Dry goose berry powder, harda powder and orange peel powder were used as natural mordants and alum, copper sulphate and ferrous sulphate were used as chemical mordants [3].

**Table: 1 Raw materials (fruits and fabric) for dyeing**

| Fresh *F. carica* | Dry *F. carica* | Silk fabric |
|---|---|---|
|  |  |  |

**d) Plant part used:** Fruits

**Methods**

**a) Extraction method**

a) **Exraction procedure of** F.CARICA
Dye extraction procedure of F.CARICA is shown in Figure 1.

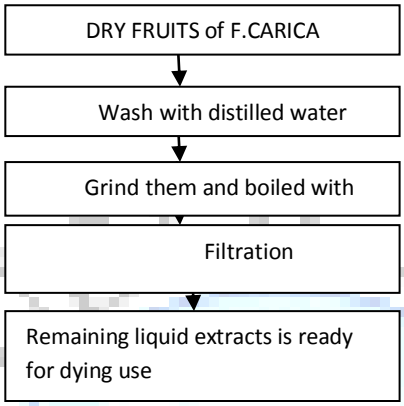


**Figure1: Exraction procedure of F.CARICA**

**b) Methods of mordanting:-**

1) **Pre - mordanting**: - in this method the silk was first treated with mordant and then dyed under optimized conditions.
2) **Simultaneous –mordanting: -** in this method the silk was dyed with mordant at a same time under optimized conditions.
3) **Post - mordanting: -** in case of post mordanting the fabric was first dyed under optimized conditions and then treated with mordant.

We have followed pre-mordanting, simultaneous mordanting and post mordanting. [7,9,10]

**Optimized dying recipe and condition of F.carica**

| | | |
|---|---|---|
| **MLR** | | **1:30** |
| **F. carica-** | | 20% owf |
| **Chemical mordant** | - | 20 % owf |
| **Natural mordant** | | -25 % owf |
| **pH** | - | 5-6.5 |
| **Temp.** | | - $90^0$C |
| **Time** | | - 60 Min. |

Dyeing was performed on water shaker bath machine at 65 rpm speed in borosil conical flask.

**Testing methods**

**a) Light fastness test**

This method is intended for determining the resistance of the colour of material to the action of a standard artificial light source. The xenon lamp has an emission wavelength profile close to daylight as per AATCC 16 test standard. [15-18]

- Exposure time 40 hrs as per AATCC 16 standard.

The fastness rating goes step-wise from:

| Grade | Degree of Fading | Light Fastness Type |
|---|---|---|
| 8 | No fading | Outstanding |
| 7 | Very slight fading | Excellent |
| 6 | Slight fading | Very good |
| 5 | Moderate fading | Good |
| 4 | Appreciable fading | Moderate |
| 3 | Significant fading | Fair |
| 2 | Extensive fading | Poor |
| 1 | Very extensive fading | Very poor |

**Table 2: Light fastness grey scale rating**

**a) Wash fastness test**

The resistance of a material to change in any of its colour characteristics, when subjected to washing is called colour fastness to washing. [5,4,8]

- **Wash fastness tester: -** Wash fastness tester is used for determining colour fastness of textile material to washing.
- **Washing procedure: -** a 10 x 4 cm swatch of the coloured fabric is taken and is sand witched between two adjacent fabrics and stitched, the sample and the adjacent fabric are washed together as per AATCC 61 test standard. [10-14]

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After soaping treatment, specimen, rinse twice in cold water and then in running cold water under a tap. Squeeze it and air dry at a temperture not exceeding 60°C. The change in colour and staining is evaluated with the help of grey scales as per AATCC 61 test standard.[19-22]

**b) Rubbing fastness test**

This method is intended for determining the transfer of colour and the behaviour of the surface of a fabric on rubbing with an undyed wool felt [124] using crockmeter tester

- **No. of rubbing cycles –** 10 (as per AATCC 8 test standard )
- **Fabric tests condition –** i) dry state ii) wet state

- The rubbing (crockmeter) fastness was ratted from 1 to 5. Rating 1 shows very poor rubbing fastness where as maximum rating 5 showes excellent rubbing fastness. [9-12]

## 3. RESULT AND DISCUSSION

In this present research study silk fabric were dyed F.carica were used following pre, meta and post mordanting method .

- Natural and chemical mordants were used as a fixing agent. (Natural mordants-Harda powder, dry goose berry powder and orange peel powder) and (Chemical mordants- ferrous sulphate, copper sulphate and alumminium sulphate).
- Aqueous extraction method was followed for extraction.
- Dyeing is performed on water shaker bath at 65rpm speed.

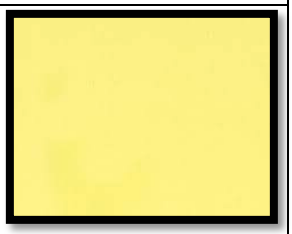
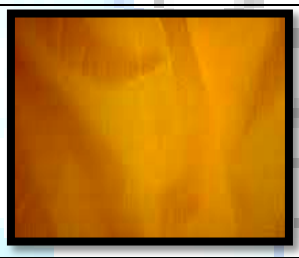
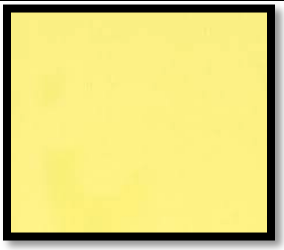
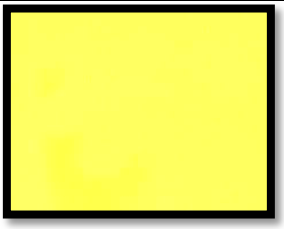
Dyeing receipe and contdition were optimized before final dyeing.[23-27]

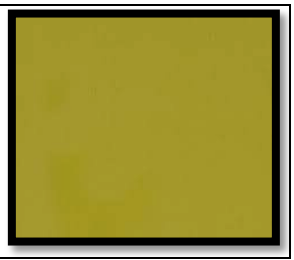
**Result of F.carica**

**Dyed silk fabrics with F.CARICA via pre, meta and post-mordanting methods**

Dyed silk fabric samples with F.CARICA via pre, meta and post mordanting method as shown in Table2.

**Table 2: Dyed silk fabrics with F.CARICA via pre, meta and post-mordanting methods.**

| F.carica dye | Pre-mordanting | Meta-mordanting | Post- mordanting |
|---|---|---|---|
| Without mordant k.p (20%) |  |  |  |
| Dry goose berry powder (25%) |  |  |  |
| Harda powder (25%) |  |  |  |
| Orange peel powder (25%) |  |  |  |
| Copper sulphate (20%) |  |  |  |
| Aluminium sulphate (20%) |  |  |  |

| | | | |
|---|---|---|---|
| Ferrous sulphate (20%) |  |  |  |

**Discussion**

**Evaluation of colour fastness** to washing and rubbing was ratted from 1 to 5. Rating 1 showes very poor wash and rubbing fastness where as maximum rating 5 showes excellent wash and rubbing fastness. Results of colour fastness to washing, rubbing that tabulated in Table.3 [28-31].

**Table 3: colour fastness of dyed silk fabric with F.carica**

| Mordanting method | Mordant used in dyeing of silk samples with F.CARICA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Colour coordinates and fastness properties | | Without mordant | Goose berry Powder | Harda powder | Orange peel powder | Copper sulphate | Alum | Ferrous sulphate |
| Pre | WF | Colour change | 5 | 4 | 3 | 4 | 4 | 5 | 3 |
| | | Stain with silk | 5 | 4 | 3 | 4 | 3 | 5 | 3 |
| | | Stain with cotton | 5 | 4 | 4 | 5 | 5 | 5 | 4 |
| | L. F | | 6 | 5 | 6 | 6 | 6 | 7 | 6 |
| | RF | Dry state | 5 | 4 | 4 | 5 | 4 | 5 | 4 |
| | | Wet state | 4 | 3 | 3 | 4 | 3 | 4 | 3 |
| Meta | WF | Colour change | 5 | 4 | 4 | 4 | 3 | 5 | 4 |
| | | Stain with silk | 5 | 5 | 4 | 5 | 5 | 5 | 4 |
| | | Stain with cotton | 5 | 4 | 4 | 4 | 4 | 5 | 3 |
| | L .F | | 6 | 6 | 6 | 5 | 5 | 7 | 6 |
| | RF | Dry state | 5 | 4 | 4 | 4 | 4 | 5 | 5 |
| | | Wet state | 4 | 3 | 4 | 5 | 4 | 5 | 4 |
| Post | WF | Colour change | 5 | 4 | 3 | 4 | 5 | 3 | 4 |
| | | Stain with silk | 5 | 4 | 3 | 4 | 3 | 4 | 5 |
| | | Stain with cotton | 5 | 4 | 4 | 5 | 5 | 4 | 5 |
| | L .F | | 7 | 6 | 6 | 6 | 5 | 8 | 6 |
| | RF | Dry state | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | Wet state | 4 | 3 | 4 | 4 | 4 | 5 | 3 |

## CONCLUSION

It can be clearly observed from the results that natural mordants have comparable affinity to chemical ones towards silk textile substrate with darker shades and brilliant hues. The colour fastness properties of natural mordants are also good in comparison to chemical mordants with excellent fastness ratings giving a substitute to synthetic mordants in eco-friendly dyeing process,dyed samples with natural as well as chemical mordants give moderate to excellent fastness properties. So, whole dyeing process can be carried out in an eco-friendly manner using natural dyes as well as natural mordants. The renewable natural dyes with eco-friendly mordants i.e. natural mordants have good potential in sustainable textile wet processing.

In this research following three mordanting methods pre, meta and post, in which post mordanting method have proved for best colour shade range than meta and pre.

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