Global Scientific JOURNALS

GSJ: Volume 6, Issue 9, September 2018, Online: ISSN 2320-9186
www.globalscientificjournal.com

DYEING OF TRADITIONAL FIBRE MATERIALS USING RUBIA CARDIFOLIA (L) DYE WITH VARIOUS MORDANTS

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1. Introduction

The ability of production natural dye is one of the oldest identified to man and dates to the dawn of evolution. It was used for colouring of fabrics and other materials including traditional craft works [1]. The natural dyes are derived from plants, animals, insects, and the minerals [2, 3]. The ancient peoples are used natural dyes for painting, dyeing of mud pot, dyeing of temple tower, etc. In India, the drama actors using natural dyes for in makeup dyes.

Beginning of the 19th century, the development synthetic dyes was completely eradicating the natural dye usage. But these synthetic dyes are not eco-friendly [4]. It may cause many ill effects on human and other organisms. So the recent days return back to the natural dyes usage. The natural dyes applied products are very expensive for their biological properties [5].

The natural fibres are a plant fibres obtained from various plant parts. In example Palmyra leaf, korai, banana screw pine, sisal, and pineapple leaf etc., used as fibre to make various traditional craft works. The child toys, mat, dress materials, jewellery and other house usage products are made by using these natural fibres. These products are dyed by synthetic dyes generate may cause ill effects to the children's [6].

The present study elaborated to the preparation of natural dye from *Rubia cardifolia* (L) plant roots and dyeing of Palmyra leaf, korai grass, banana, screw pine, sisal, and pineapple leaf fibres with the help of various mordants.

2. Materials and Methods

2.1. Materials

The powdered *Rubia cardifolia* root material was purchased from ayurvedic shop from Kanyakumari district, Tamilnadu, India. The mordants, salt, sodium bi carbonate (soda salt), tin, oxalic acid, tannic acid, ferrous sulphate (Iron), and potassium alum were purchased from merk, India. The tamarind collected from local shop. Natural fibres like palmyra leaf, korai grass, sisal, banana, screw pine, and pine apple fibres were collected from local traditional craft workers in Nagerkoil, Tamilnadu, India.

2.2. Extraction of natural dye

The collected dye material was used to prepare the natural dye using hot extraction method. 200g of dye source was mixed with 1000mL water. Then this mixture was heated at 90^{o}C for 30 minutes. Finally it was filtered using Whatmann No. 1 paper.

2.3. Preparation of Natural fibres

Before dying, the natural fibre materials were soaking in the soft water.

2.4. Preparation of mordants

Sodium chloride: 0.5g of NaCl was dissolved with 10mL of water.

Sodium bi carbonate: 0.5g of $NaHCO_3$ was dissolved with 10mL of water.

Oxalic acid: 0.5g of $C_2H_2O_4$ was dissolved with 10mL of water.

Tannic acid: 0.5g of $C_{76}H_{52}O_{46}$ was dissolved with 10mL of water.

Ferrous sulphate: 0.5g of $FeSO_4.7H_2O$ was dissolved with 10mL of water.

Potassium alum: 0.5g of KAI $(SO_4)_2.12H_2O$ was dissolved with 10mL of water.

Tamarind: One gram of cooking tamarind dissolved in 10mL water.

2.5. Dyeing of natural fibres

The prepared natural fibres were dyed by *Rubia cardifolia* plant dye (100mL) using tip coating method. The fibres are soaking in the natural dye solution for 30 minutes and add 2mL of mordants after 30minutes by meta-mordanting method.

2.6. Light fastness analysis

The dyed natural fibres are analyzed light fastness under sun light. The grayscale is used to measure the light fastness.

2.7. UV spectral study

The natural dye with mordants mixed solution was characterized using UV/Vis Spectrophotometer – 2203 in the range of 200 to 1000nm (λ max).

3. Results and Discussion

The mordant is very important role in dyeing industries. The mordants are the fixative agent that adheres well to both the fibre and to the dye [4]. The *Rubia cardifolia* natural dye to give different colours like red, yellow, pink, brown, black, and their mixing on natural fibres with the help of different mordants (Figure 1).

The light fatness study was very important for dyeing of natural fibres. Because the natural dye coated materials are easily fading by sunlight, water etc. The different mordants used this study to fix the dye on fibre material and produced different colours and coloured fibre materials have long life and do not fade by sunlight (Table 1).

The *Rubia cardifolia* dye with different mordants were analyzed UV spectra represent at figure 2. The *Rubia cardifolia* dye has single absorption in 233nm. The without mordant have three major absorption 243, 348 and 387nm. The dyes mixed with (salt) sodium chloride mordant have three major absorption in 243, 348 and 387nm. The dye mixed with sodium bi carbonate has three major absorption maxima in 243, 344 and 387nm. The dye with oxalic acid has single absorption maxima at 243nm.

The dye with tannic acid mixed has three absorption maxima in 248, 344 and 387nm. The dye with ferrous sulphate contains three absorption maxima at 243, 353 and 387nm. The dye with tin metal mixed has a single absorption in 238nm. The potassium alum mixed *Rubia* dye contains a single absorption maximum in 233nm. The dye with tamarind mixed has a single absorption at 238nm.

4. Conclusion

India has a rich tradition in traditional industries. The natural dyes are used to dyeing of traditional craft products. The mordant is very important for dyeing of natural fibres. The mordants are act as fixative to fix the natural dye on natural fibre materials. The mordant used natural dye coated fibre material have different attractive colour and do not fade by sunlight. The natural dye coated natural fibre products, craft works are high expensive and good for health. The eco-friendly products of traditional industries not only have great potential for growth in production and export but can also to widespread generation of employment opportunities in the rural areas of the country.

5. Acknowledgement

The authors extend their sincere thanks to the DST for providing funds of this research work.

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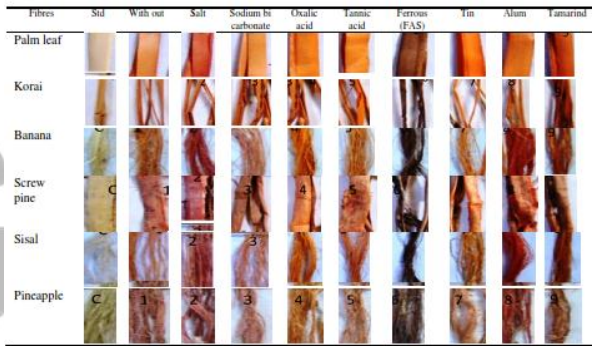

Figure 1: *Rubia cardifolia* plant dye coated natural fibres using different mordants.

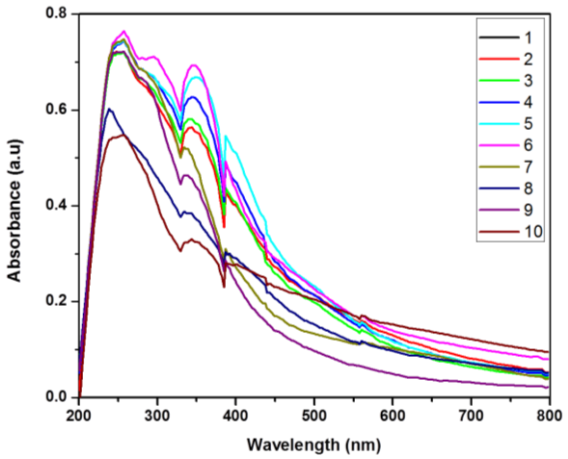

Figure 2: UV spectral data of dye with different mordants. UV data 1 is *Rubia cardifolia* plant extraction. 2. Dye without mordant. 3. Dye with sodium chloride. 4. Dye with sodium bi carbonate. 5. Dye with oxalic acid. 6. Dye with Tannic acid. 7. Dye with ferrous sulphate. 8. Dye with tin metal. 9. Dye with potassium alum. 10. Dye with cooking tamarind.

Fibre	With out	Salt	Sodium Bi carbonate	Oxalic acid	Tannic acid	Ferrous (FAS)	Tin	Alum	Tamarind
Palm leaf	1-2	2-3	2-3	1-2	3-4	4-5	3-4	3-4	3-4
Korai	1-2	2-3	1-2	2-3	3-4	2-3	2-3	2-3	2-3
Banana	2-3	2-3	2-3	3-4	3-4	3-4	4-5	3-4	4-5
Screwpine	2-3	1-2	3-4	2-3	2-3	4-5	2-3	3-4	3-4
Sisal	2-3	2-3	2-3	3-4	3-4	3-4	3-4	3-4	3-4
Pineapple	3-4	2-3	2-3	3-4	2-3	2-3	3-4	2-3	2-3

Table 1: Light fastness analysis natural dye coated fibre materials. 1-2 (poor), 2-3 (fair), 3-4 (good) and 4-5 (excellent).