ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

A STUDY ON EXTRACTION AND APPLICATION OF ECO-FRIENDLY NATURAL DYE EXTRACTED FROM FLOWERS OF *DICHROSTACHYS CINEREA* ON SILK FABRIC USING OF CHEMICAL MORDANTS

S.Thiyagarajan*, K.Balakrishnan, S.Tamilarasi

Department of chemistry, A. V. V. M. Sri Pushpam College, Poondi, Thanjavur, Tamilnadu-613503, India.

Manuscript Info

Manuscript History:

Received: 14 November 2015
Final Accepted: 26 December 2015
Published Online: January 2016

Key words:
Extraction, natural dyes, *Dichrostachys cinerea* flowers, AATCC and ISO methods, silk, textiles.

Corresponding Author

S.Thiyagarajan

Abstract

The aim of the study was to determine the performance of dyes extract from *Dichrostachys cinerea* flower. The colour fastness properties and K/S –value of dyed H_2O_2 bleached silk cloth were determined and compared. Fastness properties of the dyed cloth were determined by standard AATCC and ISO methods. From the comparative study of colour fastness properties dyed cloth washing, lightening, rubbing fastness and perspiration fastness and K/S –value of the dyed silk cloth, *Dichrostachys cinerea* in post mordanting method with 3% chemical mordant (ferrous sulphate) combination give better results.

Introduction:-

India has a rich plant species in an environment and it is not only one of the world's twelve mega diversity countries, Australia, Brazil, China, Colombia, Ecuador, democratic republic of Congo, Indonesia, Mexico, Madagascar, Peru, Venezula.Venezuela.The newly biodiversity countries Malaysia, Philippines, south Africa, USA, Papua new Guinea. But also one of the eight major centers' of origin and diversification of domesticated taxa. It has approximately 490,000 plant species of which about 17,500 are angiosperms; more than 400 are domesticated crop species for human and almost an equal number their animal and wild life[1]. Research has shown that synthetic dyes are suspected to petrochemical release harmful chemicals that are considered to be high pollutant in both water and land which would be allergic, carcinogenic, skin and hair problem and defect marine warming and detrimental to human health. Natural dyes from plants provide important alternative to based dyes and if used is watchful managed without affecting environmental and social profit. Natural dyes not only release medicinal properties but also improve the beautiful of the product and they are unique and eco friendly[4]. Recently, the many country interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental gain standards imposed by environmental board and pollution control board of many countries in response to toxic and allergic human defect reactions associated with synthetic dyes[5]. Colour fastness properties is the resistance of a material to change any of its colour characteristic are extent of transfer of its colorants to adjacent which materials in touch generally fastness properties are considered far textile cloth[6]. Environmental pollution due to the discharge of dyeing industry effluents is the matter of major concern now-a-days. Some and drinking water, lack, pond also major polluted up to the end of 19th century natural dyes were the main colourants for textiles. Recently, interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards not toxic, allergic human being imposed by many countries in response to toxic and allergic reactions associated with synthetic dyes[7]. Up to about 150 years ago all dyes were natural substances, derived mainly from plants and animals. The natural dyes present in plants part fruit, seed, flower, steam, leaves and animals[8]. Which major colour to the materials. With the world becoming more conscious towards ecology and environment, there is greater need today to revive the tradition of natural dye and dyeing techniques as an alternative of hazardous synthetic dyes is an extremely dangerous government to move action produced natural dye to industry for action. There are several plants/plant parts that

provide natural dyes which are used in the textile industry. This type of synthetic dye are used so for good constant colour so used industry However, the common drawbacks of natural dyes are their non-reproducible and non-uniform shades, poor to moderate colour fastness and lack of scientific information on the chemistry of dyeing and standardised dyeing methods [9,10]. Many reports are available on application of natural dyes on silk[11,12].

Materials and Methods: -

Materials:-

Plant Collection:-

The flowers of *Dichrostachys cinerea* was collected from alivalam village, Thanjavur district and authenticated by Dr.S.John Britto, Rapinat Herbarium, St.josephs College, Trichy.

Fabric: -

For the silk fabric bleaching process M: L ratio 1:40 is used. One gram of silk fabric sample has been taken in 100ml of beaker. 4 volumes (20ml) of H_2O_2, 20mlof 5% sodium pyrophosphate and 2ml of 5% EDTA are added with the fabric. 8 ml of water is added to this solution and heated about 80-85°c for 1hours and pH is mandated to 9. The silk samples have been dried.

Mordants:-

Chemicals used:

Analytical reagents metallic salts such as copper sulphate, ferrous sulphate, aluminium sulphate, Potassium dichromate, stannous chloride was used as chemical mordants.

Experimental:-

Dye Extraction:-

Above 200g of fresh flowers was weighed and taken in RP flash and soaked with 500 ml of 80% ethanol. The RP flash apparatus was heated 70°c for 60 min. After extraction, the extract was filtered and used for dyeing.

Effect of M: L Ratio:-

The silk cloth was dyed with dye extracts keeping various M: L ratio as 1:10, 1:20, 1:30 and 1:40. It was observed that the dye uptake was good in M: L ratio 1:20.

Dyeing procedure:-

The silk cloth was dyed with dye extract maintenance M: L ratio as 1:20 dyeing was carried out at 78°c and continued for 1hour.

Mordanting:-

The silk cloth was treated and with different chemical mordant's by following three methods[7].

(i) pre- mordanting
(ii) simultaneous mordanting
(iii) post- mordanting

(i) Pre-Mordanting of silk fabrics with metallic salts:-

Bleached silk cloth with pre mordanting were added to dyeing of following any one chemical mordant's, such as $K_2Cr_2O_7$, Al_2SO_4, $CuSO_4$, $SnCl_2$, and$FeSO_4$ at 60°C for 30 min. And mordant cloth and added with natural flower extract and added some amount of water and heated. After 10 minutes added required amount of acetic acid. After 20 minutes added required amount of sodium chloride was added, 1 hour heated at 78°C with M:L ratio of 1:20 then it is added to the flowers extract. The dyed cloth were again washed with water and then dried in air.

(ii) Simultaneous -Mordanting of silk fabrics with metallic salts:-

Bleached silk cloth with natural dye extract and, using any one of the chemical mordant's, such as $K_2Cr_2O_7$, Al_2SO_4, $CuSO_4$, $SnCl_2$, and $FeSO_4$ added some amount of water. After 10 minutes added required amount of acetic acid. After 20 minutes added required amount of sodium chloride was added, 1 hour heated at 78°C with M:L ratio of 1:20. The dyed cloth were again washed with water and then dried in air.

(iii) Post-Mordanting of silk fabrics with metallic salts:-

Bleached silk cloth with natural dye extract and, added some amount of water and heated. 1 hour heated at 78°C. And natural dyed cloth and any one of the chemical mordant's, such as $K_2Cr_2O_7$, Al_2SO_4, $CuSO_4$, $SnCl_2$, and $FeSO_4$ at After 10 minutes added required amount of acidic acid After 20 minutes added required amount of sodium chloride was added, 30 minutes heated at 60°C with M:L ratio of 1:20. The dyed cloth were again washed with water and then dried in air.

Color fastness: -

The colour fastness of the dyed fabrics was tested according to AATCC & ISO standards. Color fastness to washing, light, rubbing and perspiration were determined from standard test methods. Wash fastness using Launder O Meter (AATCC – 110106), Light Fastness (AATCC test method 16-1993). Rubbing Fastness IS: 766-1956, and Acidic and Alkaline Perspiration (AATCC test method 15-1997) respectively[8].

Measurement of colour strength: -

The spectral reflectances of the dyed samples were measured using a Text flash spectrophotometer (Data colour corp.). The K/S values were calculated by Kubelka-Munk equation.

$$K/S = (1-R)^2 / 2R$$

Where, R is the decimal fraction of the light reflectance of the dyed fabric at λmax. K is the absorption coefficient and S is scattering coefficient[9].

Result and Discussion:-

Sox let Extraction Method:-

About 200 g of *Dichrostachys cinerea* fresh flowers and added with (80% of ethanol + 20% water) and socking 15 minutes. 500 ml of RB flask highly heated to 60 minutes at 70°c. Then transferred to after extractions was filtered and used as a natural dye. It was noticed that, colour of the dye extract was brown colour.

Effect of Mordanting:-

Dichrostachys cinerea flower dye extract was found to be suitable for silk cloth. The silk cloth were dyed with chemical mordants. In all the three dyeing method, post mordanting method gave excellent results. In all the three dyeing, using flowers extract the mordant's ferrous sulphate show gave excellent results. For dyeing of silk, 1%, 3% and4% mordant concentrations were used for present study. Among these three concentrations 3% mordant's concentration gave better results shown in figure – 1.

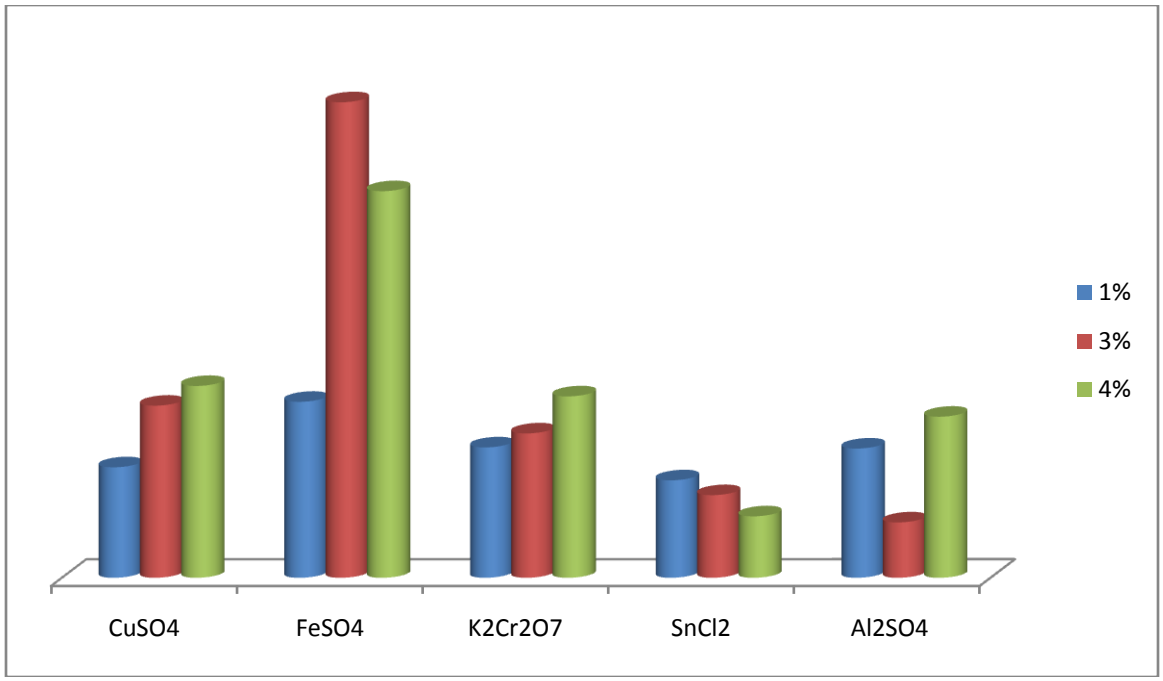

Figure-1: Effect of mordant method in silk cloth dyes

Optimization of mordants with K/S value and colour hue changes:-

Various hues of colour were obtained from pre mordant method in 3% mordants silk with copper sulphate, ferrous sulphate, aluminium sulphate, potassium dichromate, stannous chloride. The different mordants not only cause difference in hues of colour and significant changes in K/S values but also changes in L* Values and brightness index value. The effect of mordants on colour values of cotton dyed with *Dichrostachys cinerea* flower is shown in figure-2.

Table-1 shows L*, a*, b,* C *, H*and colour strength K/S values and it can be seen that, mordants which show higher value of L*show lighter shades while lower L*value show darker shades for. Further more negative values of a*and b* appearance green and blue properly C^*chromaticity, H^* hue of the colour. Among the chemical mordants used, the highest colour value (K/S =147.132) was obtained with ferrous sulphate and lowest colour value (K/S =17.135) with aluminium sulphate.

Table-1: Different post mordant method in 3% mordants L^*, a^*, b^*, C^*, H^* and K/S values for silk dyed cloth

S.NO	Mordant's	L^*	a*	b*	C^*	H^*	K/S Value
1	$CuSO_4$	57.321	7.424	25.164	26.236	73.533	53.252
2	$FeSO_4$	36.348	1.335	6.959	7.086	79.109	147.132
3	$K_2Cr_2O_7$	60.121	9.102	26.384	27.91	70.938	44.669
4	$SnCl_2$	70.789	7.981	31.825	32.81	75.891	25.575
5	Al_2SO_4	74.569	2.890	25.468	25.631	83.492	17.135

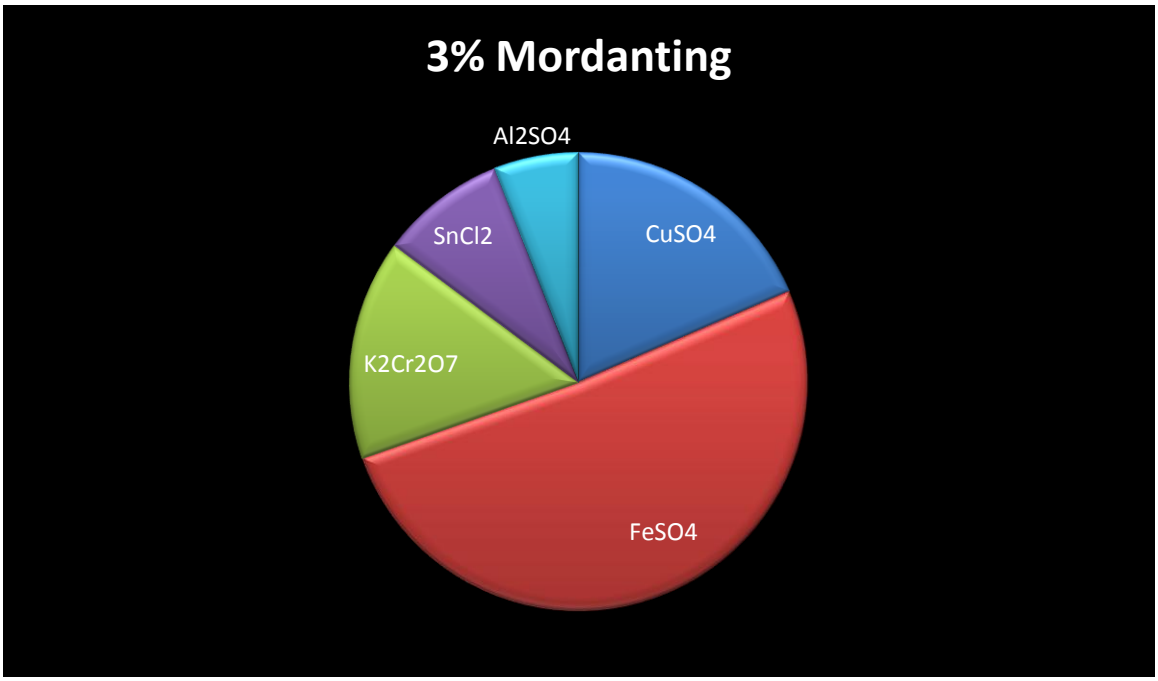

Figure 2: Effect of mordant method in 3% mordants for silk dyed with post mordant.

Fastness properties:-

It was observed that, dyeing with *Dichrostachys cinerea* flowers of gave good washing, light and rubbing fastness properties. The fastness properties of dyed of silk cloth are shown in Table2.

Table2: Fastness properties for silk cloth dyed with flowers of *Dichrostachys cinerea*

Mordant's	**Method of mordanting**	**Mordant concentration (%)**	**Washing**		**Rubbing**		**Sun light**	**Perspiration**			
								Acidic		**Alkaline**	
			CC	**CS**	**Dry**	**Wet**		CC	CS	CC	CS
$CuSO_4$	Pre-mordanting	1	4	5	4-5	4	4	5	5	4	5
		3	5	5	4-5	4	5	5	5	5	5
		4	5	5	4-5	4	5	5	5	5	5
	Simultaneous mordanting	1	4	5	4-5	4	5	5	5	4	5
		3	4	5	4-5	4	5	4	4-5	4	4-5
		4	4	5	4-5	4	5	4	5	4	5
	Post-mordanting	1	4	5	4-5	4	5	4	5	4	5
		3	4	5	4-5	4	5	4	5	4	5
		4	4	5	4-5	4	5	4	5	4	5
$FeSO_4$	Pre-mordanting	1	4	5	4-5	4	4	4	4-5	4	5
		3	4	5	4-5	4	5	4	4-5	4	5
		4	4	5	4-5	4	4	4	4-5	4	4-5
	Simultaneous	1	4	4-5	4-5	4	5	4	4-5	4	4-5

	mordanting	3	4	4-5	4-5	4	5	4	4-5	4	4-5
		4	4	4-5	4-5	3-4	5	4	5	4	5
	Post-mordanting	1	4	4-5	4-5	4	5	4	5	4	5
		3	4	5	4-5	4	5	4	5	4	5
		4	4	5	4-5	4	5	4	5	4	5
$K_2Cr_2O_7$	Pre-mordanting	1	5	5	4-5	4	5	5	5	4	5
		3	5	5	4-5	4	4	5	5	5	5
		4	5	5	4-5	4	4	5	5	5	5
	Simultaneous mordanting	1	4	5	4-5	4	4	4	5	4	5
		3	5	5	4-5	4	4	5	5	4	5
		4	4	5	4-5	4	5	4	5	4	5
	Post-mordanting	1	4	5	4	5	4	5	5	4	5
		3	5	5	4-5	4	4	5	5	4	5
		4	5	5	4-5	4	4	5	5	4	5
$SnCl_2$	Pre-mordanting	1	5	4-5	4-5	4	4	4	5	4	5
		3	5	4-5	4	3-4	4	5	5	5	5
		4	5	4-5	4-5	4	4	5	5	5	5
	Simultaneous mordanting	1	5	5	4-5	4	4	5	5	5	5
		3	4	5	4-5	4	4	5	5	4	5
		4	5	5	4-5	4	4	4	5	5	5
	Post-mordanting	1	4	5	4-5	4	5	5	5	5	5
		3	4	5	4-5	4	5	4	5	4	5
		4	5	5	4-5	4	5	4	5	4	5
Al_2SO_4	Pre-mordanting	1	5	4-5	4-5	4	5	4	5	4	4-5
		3	5	4-5	4-5	3-4	4	4	5	4	4-5
		4	4	4-5	4	4	4	4	5	4	4-5
	Simultaneous mordanting	1	5	4-5	4-5	4	5	4	5	4	4-5
		3	4	4-5	4-5	4	5	4	5	4	5
		4	4	4-5	4-5	4	5	4	5	4	4-5
	Post-mordanting	1	4	4-5	4-5	4	5	4	5	4	5
		3	4	5	4	5	5	4	5	4	5
		4	4	4-5	4-5	4	5	4	5	4	5

Conclusion:-

The dyeing of silk can achieved using the flower extracts of *Dichrostachys cinerea* by using chemical mordants .The washing, light and rubbing fastness of all dyeing with mordants were quite good. From the comparative study of fastness properties the dyed silk cloth *Dichrostachys cinerea* in post mordanting method with 3% (ferrous sulphat) mordant combination gives better results.

References:-

1. Manual on Exploration and Collection of Plant Genetic Resources and Related Indigenous Knowledge, National Bureau of Plant Genetic Resources, New Delhi, 2000.

2. Thomas Bechtold, Journal of the Science Food and Agriculture, 86: 233-242, 2006.

3.Purrohit A., Mallick S., Nayak A., Das N.B., Nanda B. and Sahoo S., *Current science***,** 92, 12 2007.

4**.** Neha Grover and Vidya Patni Extraction and application of natural dye preparations from the floral parts of Woodfordia fruticosa (Linn.) Kurz, Indian Journal of Natural Products and Resources Vol. 2(4), pp 403-408,2011.

5**.** Kamel M, El-Shishtawy R M, Yussef B M and Mashaly H. Ultrasonic assisted dyeing III. Dyeing of wool with lace as a natural dye, Dyes Pigments, 65, 103-110, 2005.

6. Kulkarni. S.S, Gokhale. A.V, Bodake.U.M and Pathade.G.R, Cotton dyeing with Natural Dye Extracted from Pomegranate Peel, Universal Journal of Environmental Research and Technology, Vol. 1(2): 135-139, 2011.

7.K.Anitha, S.N.Prasad, Developing multiple natural dyes from flower parts of Gulmohur, Current Science, Vol.92,12,1681-1682,2007.

8.Sandeep Bains, O.P.Singh, Ganganpreet Goraya and Manpreet Kang, Dyeing of Cotton with Golden drop dye, Journal of the Textile Association, 183-186, Nov.-Dec.,2003.

9.Samanta A.K, Singhee Deepali & Seethia Mitu. Colourage, 50(10),29. 2003.

10.Gulrajani M L & Gupta Deepti, Natural Dye and their Application to Textiles (Department of Textiles (Department of Textile Technology, IIT, Delhi), 25, 1992.

11.Mahale G Sakshi & Sunanda R.K, Indian J Fibre Text. Res., 28,86, 2003.

12.Anderson B., Creative Spinning, Weaving and Plant Dyeing, Angus and Robinson , Singapore,24-28,1971.

13. M.Kumaresan, P.N.Palnisamy and P.E.Kumar, Application of Ecofriendly Natural Dye Obtained from flower of Spathodea Campanulata on Silk, European Journal of Scientific Research,Vol.52, No.3, pp.306-312. 2011.

14. Vankar P.S., Shanker R. and Dixit S., Pigment and Resin Technology, 37(5), 2008.

15.S.Habibzadeh, H. Tayebi, E..Eerami, A.Shams Nateri M.Allahnia and M.Bahmai, silk Dyeing Using Saw- Wood of the Zelkoa Forest Tree, World Applied Journal, 9(3), 295-299, 2010.