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Extraction and application of eco- friendly natural dye obtained from flower of *Acacia eburnea* (L.f.) willd on silk fabric

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ABSTRACT

In this present study dye extract was prepared from flower of Acacia eburnea (L.f.) Willd was used as a source of natural dyes for dyeing of silk samples. It belongs to family Fabaceae. So in the present investigation, bleached silk fabrics were dyed with different chemical mordant's such as pre-mordanting, post-mordanting and simultaneous-mordanting. In this method post mordanting of ferrous sulphate 4% compound gave good K/S -value compare than other. The dyed fabrics have show good washing, light, rubbing fastness and perspiration fastness properties.

Keywords: Extraction, natural dyes, flowers, *Acacia eburnea* (L.f.) Willd, ISO methods silk, textiles.

INTRODUCTION

India has a largest tradition in the use of natural dyes. Natural dyes have been a part of human life since time immemorial and synthetic were the only colourants in the word but more problems also. But with the invent of synthetic dyes about 175 years back use of natural dyes have witnessed diminished synthetic dyes are low cost. So many industries used synthetic dyes. During last two decades natural dyes have witnessed a process of revival [1]. With the increasing awareness of consumers far eco textiles and need to preserve environment has lead to the revival of old practice of coloration with natural dyestuff synthetic dyes are reduced to mankind. Due to the affect human body what natural of some synthetic dyes and their intermediates natural some synthetic dyes and their intermediates natural dyes are being looked at as an "eco solution" to the ill highly effects of synthetic dyes and natural dye not effect . The serious limitation associated within the natural dyes is the process of dyeing with natural dyes in very lengthy and time consuming moreover reproducibility of shades is also a major problem faced in dyeing with natural dyes as traditional processes for their application on various substrates have been lost in the absence of proper documentation and years of neglect synthetic dyes has low time consuming so used textile industry. Therefore, it becomes necessary to develop new techniques of coloration and also to standardize these processes with the help of modern scientific. So that these dyes can offer themselves as an effective eco option [2]. Natural dyes are known for their use in colouring of food substrate, home appliance textile industry and ancient times . Natural dyes may have a wide range of shades and can be obtained from various parts of plants and animal origin since the advent of widely available and cheaper synthetic dyes in 1856 having moderate to colour fastness properties, the use of natural dyes having poor to moderate wash and light fastness has declined to a great extent . However, recently there has been revival of the growing interest on the application of natural dyes on natural fibers due to worldwide global warming [3].In many of the world's developing countries, natural dyes can offer not only rich and varied source of dye stuff, but also the possibility of an income through sustainable harvest and sale of these plants and developed environment [4]. Today due to global environment awareness trend of using natural colors is drawing production and application

of synthetic dyes release large amount of waste and unfixed colour and causing health hazards pollution and disturb eco – balance and human problems in the finished textiles especially which are coming in contact with the skin has opened new challenges for the persons working in the field of textiles [5].

Natural dyes have better biodegradability with the environment. They are non-toxic non – allergic to skin non – carcinogenic, easily available and renewable. Synthesis dyes are toxic allergic easily available and non renewable [6].

Acacia eburnea (L.f.)Willd a small tree with red-purple corolla and yellow stamens and large ivory-white thorns, the pods papery, the leaf lets. Plant Name *Acacia eburnea* (L.f.) Willd. Family Fabaceae.

MATERIALS AND METHODS

Materials:

Plant Collection

Acacia eburnea (L.f.) Willd flowers was collected from pannavayal village, Thanjavur district and authenticated by Dr. S. John Britto, Rapinat Herbarium, St. Josephs College,

Fabric:

For the silk fabric bleaching process M: L ratio 1:40 is used. One g 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:

Chemical used:

AR grade metallic salts such as copper sulphate, ferrous sulphate, aluminium sulphate, potassium dichromate, stannous chloride was used as chemical mordant's.

Experimental:

Dye Extraction:

Above 300 g of *Acacia eburnea* (L.f.) Willd fresh flowers was weighed and taken in sox let apparatus and 500 ml of solvent (ethanol: water) in the ratio 80:20 was added to it. The sox let 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 1:30.

Dyeing procedure:

The silk cloth were dyed with dye extract keeping M: L ratio as 1:30 dyeing was carried out at 78°C and continued for 1hour.

Mordanting:

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

(i) pre- mordanting

(ii) simultaneous mordanting

(iii) post- mordanting

Pre-Mordanting of silk cloth with Chemical Mordants:

Bleached silk cloth with pre-mordanting were further mordanted prior to dyeing using 1%, 3% and 4% of any one of the chemical mordant's, such as aluminium sulphate, ferrous sulphate, potassium dichromate, stannous chloride, copper sulphate at 60°C for 30 min. Mordant cloth and added with natural flower extract and added some amount of water and heated. After 10 min added required amount of acetic acid. After 20 min added required amount of sodium chloride was added, 1 hour heated at 78°C with M:L ratio of 1:30 then it is added to the flowers extract. The dyed cloth were again washed with water and then dried in air.

Simultaneous -Mordanting of silk fabrics with Chemical Mordants:
Bleached silk cloth with natural dye extract and, using 1%, 3% and 4% any one of the chemical mordant's, such as aluminium sulphate, ferrous sulphate, potassium dichromate, stannous chloride, copper sulphate added some amount of water. After 10 minutes added required amount of acetic acid. After 20 min added required amount of sodium chloride was added, 1 hour heated at 78°C with M:L ratio of 1:30. The dyed cloth were again washed with water and then dried in air.

Post-Mordanting of silk Cloth with Chemical Mordants:
Bleached silk cloth with natural dye extract and, added some amount of water and heated. 1 hour heated at 78°C. And natural dye extract cloth and using 1%, 3% and 4% any one of the chemical mordant's, such as aluminium sulphate, ferrous sulphate, potassium dichromate, stannous chloride, copper sulphate at After 10 minutes added required amount of acidic acid After 20 mintues added required amount of sodium chloride was added, 30 minutes heated at 60°C with M:L ratio of 1:30. 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 ISO standards. Color fastness to washing, light, rubbing and perspiration were determined from standard test methods. ISO – 105- C06: 2010, ISO 105- BO2: 2014, ISO: 766-1956, and ISO-E04:2013 respectively [8].

Measurement of colour strength:
The colour strength of the dyed silk cloth was determined by K/S values. The light reflectances of the dyed silk cloth 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 samples at λmax. K is the absorption coefficient and S is scattering coefficient [9].

RESULTS AND DISCUSSION

Sox let Extraction Method:
About 300 g of *Acacia eburnea* (L.f.) Willd 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 were filtered and used as a natural dye. It was noticed that, colour of the dye extract was brownish yellow colour.

Effect of Mordanting:
The dye extract was found to be suitable for silk cloth. The silk cloth was dyed with chemical mordant's. It was observed that, the dye uptake was found to be good in Post mordanting method is shown in figure – 1.

Optimization of mordant's with K/S value and colour hue changes:
The different mordant's 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 mordant's on colour values of silk cloth dyed with *Acacia eburnea* (L.f.)Willd flowers 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, mordant's which show higher value of L*show lighter shades while lower L*value show darker shades for. Furthermore, negative values of a*and b* appearance green and blue properly C*chromaticity H*hue of the colour among the chemical mordant's used, the highest colour value (K/S =178.595) was obtained with $FeSO_4$ and lowest colour value (K/S =13.072) with $SnCl_2$.

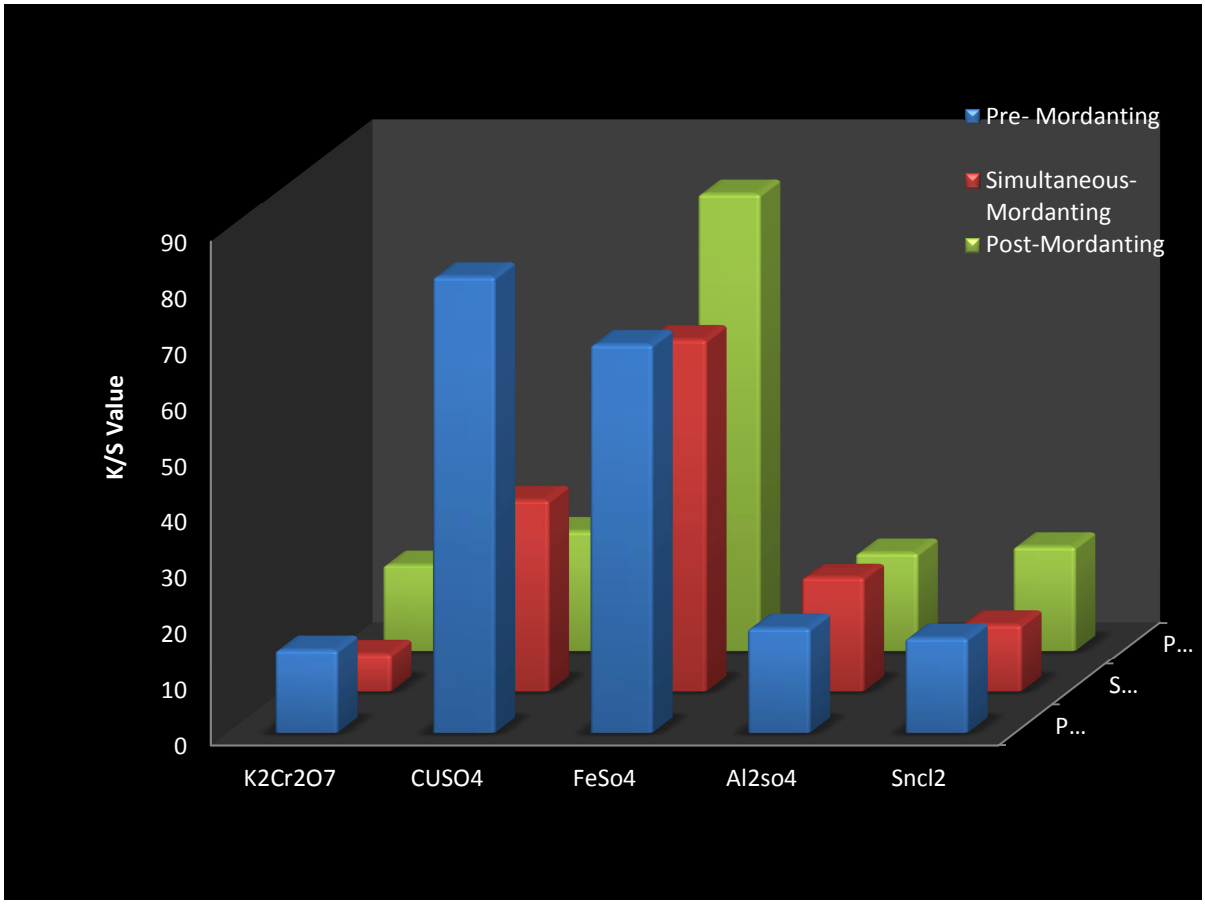

Figure – 1 Surface colour strength (K/S values) of dyed Silk cloth after pre, post and simultaneous Mordanting

Figure- 2: Effect of Mordants on colour Values of silk with Flowers of *Acacia eburnea* (L.f.) Willd *(Post-Mordanted)*

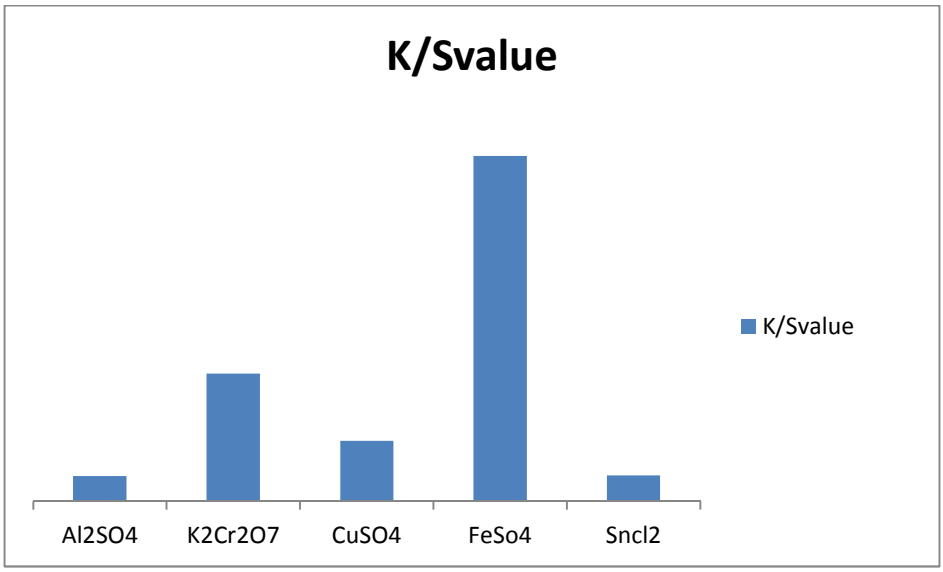

Table-2: Different Post mordant's L*, a*, b,* C *, H* and K/S Values for silk cloth dyed with *Acacia eburnea* (L.f.)Willd (flowers)

S.NO	Mordants	L*	a*	b*	C*	H*	K/S Value
1	Al_2SO_4	74.838	0.416	17.919	17.924	88.634	13.072
2	$K_2Cr_2O_7$	56.707	7.448	24.794	25.889	73.250	66.087
3	$CuSO_4$	64.293	3.209	23.427	23.646	82.167	31.355
4	$FeSO_4$	33.211	0.957	5.106	5.475	68.826	178.595
5	$SnCl_2$	72.485	2.912	11.565	11.926	75.837	13.444

Fastness properties:

It was observed that, dyeing with *Acacia eburnea* (L.f.) Willd gave good washing, light and rubbing fastness properties. The fastness properties of dyed of silk cloth are shown in Table-2. Overall, it could be used for commercial purposes and attain acceptable range.

Table-2: Fastness properties for silk cloth dyed with flowers of *Acacia eburnea* (L.f.) Willd

Mordant's	Method of mordanting	Mordant concentration (%)	Washing		Rubbing		Sun Light	Perspiration			
								Acidic		Alkaline	
			CC	CS	Dry	Wet		CC	CS	CC	CS
Al_2SO_4	Pre-mordanting	1	4	5	4	4	5	3	5	3	5
		3	4	5	4-5	4	4	2	5	4	3
		4	4	4-5	4	4	2-3	4-5	4-5	4	4-5
	Simultaneous mordanting	1	4	5	4-5	4	4	5	5	4	5
		3	5	5	4-5	4	5	5	5	2	5
		4	4	5	4-5	4	5	5	5	5	5
	Post-mordanting	1	4	5	4	4	4	1	5	4	5
		3	5	5	4-5	4	5	3	5	4	5
		4	5	5	4-5	4	5	4	5	4	5
$K_2Cr_2O_7$	Pre-mordanting	1	5	1	4-5	4	4	3	4	3	5
		3	2	5	4-5	4	4	3	4	4	5
		4	4	4-5	4	4	4	4-5	4-5	4-5	4-5
	Simultaneous mordanting	1	1	5	4-5	4	4	4	5	4	5
		3	5	1	4-5	4	4	4	5	4	5
		4	4	5	4-5	4	4	3	4-5	3	5
	Post-mordanting	1	1	5	4-5	4	5	4	5	5	5
		3	4	5	4-5	4	3	1	5	1	5
		4	5	4	4-5	4	4	4	5	4	5
$CuSO_4$	Pre-mordanting	1	4	5	4	3-4	4	4	4-5	4	4-5
		3	4	5	4	3-4	4	4-5	4	4	4-5
		4	4	5	4	3-4	5	4-5	4	4-5	4
	Simultaneous mordanting	1	4	5	4-5	4	5	4-5	4	4-5	4
		3	4	4-5	4-5	4	4	4	5	4	5
		4	4	4	4-5	4	4	4	5	4	4-5
	Post-mordanting	1	3	4	4	3-4	4	4	4-5	4	5
		3	3	4-5	4	3-4	5	4	4-5	4	4-5
		4	4	4-5	4-5	4	5	4	5	4	4-5
$FeSO_4$	Pre-mordanting	1	1	5	4-5	4	5	5	5	5	5
		3	4	1	4	3-4	5	4-5	4	5	5
		4	4	5	3-4	2-3	5	4	4-5	4	4-5
	Simultaneous mordanting	1	3	5	3-4	4	5	4	4	4	3-4
		3	3	5	3	5	5	4-5	4	4-5	4
		4	3	5	4-5	4	5	4	4-5	4	4-5
	Post-mordanting	1	1	5	4-5	4	4	4	4-5	4	4-5
		3	1	5	4	3-4	4	4	5	4	4-5
		4	**5**	**5**	**4-5**	**5**	**5**	**5**	**5**	**5**	**5**
$SnCl_2$	Pre-mordanting	1	4	4-5	4-5	4	5	3	4-5	1	4-5
		3	4	4-5	4-5	4	5	2	4-5	2	4-5
		4	**5**	**5**	**4-5**	**4**	**5**	**5**	**4-5**	**5**	**4-5**
	Simultaneous mordanting	1	3	5	4	3-4	5	2	5	2	5
		3	4	4-5	4-5	4	5	3	5	3	5
		4	4	5	4-5	4	5	3	5	3	5
	Post-mordanting	1	3	5	4-5	4	4	1	5	1	5
		3	4	5	4-5	4	4	1	5	1	5
		4	4	5	4-5	4	4	1	5	1	5

CONCLUSION

The dyeing of silk can achieved using the flower extracts of *Acacia eburnea* (L.f.)Willd by using chemical mordant's. The washing, light and rubbing fastness of all dyeing with mordant's were quite good. From the comparative study of fastness properties the dyed silk cloth, *Acacia eburnea* (L.f.)Willd in Post mordanting method with ferrous sulphate 4% mordant gives better results.

REFERENCES

[1]Gulrajani M.L., Introduction to natural dyes. IN: Gulrajani, M.L. and Gupta, D. (Ed) *Natural Dyes and their Applications to Textiles* **1992**, 1-7, IIT, Delhi
[2]Yadav Saroj, Rose Neelam, Singh Jeet Saroj and Khambra Krishnanatureal *Research Journal of Recent Sciences*, **2013**, vol. 2 (ISC-**2012**), 308-311.
[3]Ashis Kumar Samanta and Priti Agarwal, *Indian Journal of Fibre and textile Research*, **2009,** 34**,** 384-399.
[4]G.W. Taylor, *Review of Progress in Colouration*, **1986,** pp-53.
[5]Anjali Deshmukh colour gamut of holarrhena antidysentrica linn. *Dyed silk rmutp International Conference*: Textiles & Fashion **2012**.
[6] Kulkarni. S.S, Gokhale. A.V, Bodake.U.M and Pathade.G.R, *Universal Journal of Environmental Research and Technology*, **2011**, Vol. 1(2): 135-139.
[7] S.Thiyagarajan, K.Balakrishnan, S.Tamilarasi *International Journal of Advanced Research* **2016**, Volume 4, Issue 1, 1053- 1059.
[8] Vankar P.S., Shanker R. and Dixit S., *Pigment and Resin Technology*, **2008,** 37(5).
[9]S.Habibzadeh, H. Tayebi, E..Eerami, A.Shams Nateri M.Allahnia and M.Bahmai, *World Applied Journal*, **2010,** 9(3), 295-299.