



Scholars Research Library

Der Pharma Chemica, 2015, 7(4):257-260
(<http://derpharmachemica.com/archive.html>)



ISSN 0975-413X
CODEN (USA): PCHHAX

Comparison of properties of eco- friendly natural dyed cotton fabric

M. Kumaresan

Department of Chemistry, Erode Sengunthar Engineering College, Thudupathi, Erode, Tamilnadu

ABSTRACT

Fastness properties of the flower of *Spathodea campanulata* and *Cordia sebestena* dyed cotton fabric have been studied using different combination (1:3,1:1 and 3:1) of various mordants, such as myrobolan:nickel sulphate, myrobolan: aluminium sulphate, myrobolan: potassium dichromate, myrobolan: ferrous sulphate and myrobolan: stannous chloride. The wash, rub, light and perspiration fastness of the dyed samples have been evaluated. Comparing the fastness properties and colour strength of flower of *Spathodea campanulata* and *Cordia sebestena* dyed cotton by using combination of mordants. In the comparative study of fastness properties and colour strength of the dyed cotton samples *Spathodea campanulata* in simultaneous mordanting method with 1: 3 mordant combination gives better results than using flower of *Cordia sebestena*.

Keywords: *Cordia sebestena*, Cotton, Dyeing, Mordant, Natural dye, *Spathodea campanulata*

INTRODUCTION

Natural dyes are the main colourants for textiles up to the end of 19th century. But the introduction of synthetic dyes led to an almost complete replacement of natural dyes, due to favorable application properties of synthetic dyes. Besides, a wide range of available colours, higher reproducibility and improved quality of dyeing could be achieved at lower specific cost. However, recently the interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards imposed by many countries in response to toxic and allergic reactions associated with synthetic dyes [1-2]. Hence, due to the current eco-consciousness, the researcher's attention has been shifted to the use of natural dyes for dyeing textile materials[3].

MATERIALS AND METHODS

The present investigation deals with the extraction of natural dye from the flower of *Spathodea campanulata*. *Spathodea* is a monotypic genus in the flowering plant family Bignoniaceae. *Spathodea campanulata* is commonly known as the Fountain tree, African tulip tree. It is native to tropical Africa. This tree is planted extensively as an ornamental tree throughout the tropics and is much appreciated for its very showy reddish-orange or crimson (rarely yellow), campanulata flowers. It is commonly planted as a street tree in India. The generic comes from the Ancient Greek words.



Figure 1 *Spathodea campanulata*

The flower of *Spathodea campanulata* dye was used to extract colourant for dyeing cotton at optimized dyeing conditions [4-6], using combination of mordants and then the colour fastness of the dyed samples to washing, rubbing, perspiration and light evaluated.

Cordia sebestena is a species of flowering plant in the Boraginaceae family. It is commonly known as Geiger tree. *Cordia sebestena* is widely planted throughout the tropics and subtropics as an ornamental plant in gardens because of its flowers.



Figure 2 *Cordia sebestena*

It is native to the American tropics, from southern Florida in the United States (http://en.wikipedia.org/wiki/cordia_sebestena). In this study the flower of *Cordia sebestena* was used.

Bleached cotton fabric obtained from Gandhigram Rural University, Dindugal, was used for the study. Analytical reagents (AR) grade ferrous sulphate, aluminium sulphate, nickel sulphate, potassium dichromate, stannous chloride, commercial grade acetic acid, common salt, sodium carbonate were used. A natural mordant myrobolan (*Terminalia chebula*) powder [7-8] was used for the study. The ethanol extract of the flower of *Spathodea campanulata* was used to get brown colour component for dyeing of fabrics. Depending upon the mordant used, the colour obtained on textiles from the flower of *Spathodea campanulata* extract may give different shades.

A known quantity of flower of *Spathodea campanulata* was dried, powdered and soaked in warm water overnight. The colour extract was obtained by boiling it in the same water. This dye extract was allowed to cool, finally filtered and used for dyeing. The dyeing was carried out at optimized dyeing conditions: dye extraction time 60min, material-to-liquor ratio 1:20, temp. 60°C, wave length 420 nm and dyeing time 50 min. The mordant combinations, viz. myrobolan: nickel sulphate, myrobolan: aluminium sulphate, myrobolan: potassium dichromate, myrobolan: ferrous sulphate, myrobolan: stannous chloride were used each in the ratio of 1:3, 1:1 and 3:1. The total amount of two mordants used in each combination was 5% owf, i.e. 5 g of the mordant / 100 g of the fabric. Each of the five mordant combinations in three different ratios mentioned above was used with all the three mordanting methods [9-10], namely pre-mordanting, simultaneous mordanting and post-mordanting for dyeing.

Colour fastness [11-12] to washing of the dyed fabric samples was determined as per IS: 764 – 1984 method using a Sasmira launder-O-meter following IS-3 wash fastness method. The wash fastness rating was assessed using grey scale as per ISO-05-A02 (loss of shade depth) and ISO-105-A03 (extent of staining) and the same was cross-checked by measuring the loss of depth of colour and staining using Macbeth 2020 plus computer-aided colour measurement system attached with relevant software. Colour fastness to rubbing (dry and wet) was assessed as per IS: 766-1984 method using a manually operated crock meter and grey scale as per ISO-105-A03 (extent of staining).

Colour fastness to exposure to light was determined as per IS: 2454-1984 method. The sample was exposed to UV light in a Shirley MBTF Microsal fade-O-meter (having 500 watt Philips mercury bulb tungsten filament lamp simulating day light) along with the eight blue wool standards (BS1006: BOI: 1978). The fading of each sample was observed against the fading of blue wool standards (1-8).

Colour fastness to perspiration [13-15] was assessed according to IS 971-1983, composite specimen was prepared by placing the test specimen between two adjacent pieces of cotton and stitched all among four sides. The sample was soaked in the test solution (acidic /alkaline) separately with MLR 1:50 for 30 min at room temperature. The sample was then placed between two glass plates of perspirometer under load of 4.5kg (10 lbs). The apparatus was kept in the oven for 4 h at $37\pm 2^\circ\text{C}$. At the end of this period, the specimen was removed and dried in air at a temperature not exceeding 60°C . The test samples were graded for change in colour and staining using grey scales.

RESULTS AND DISCUSSION

The evaluation of colour fastness to light, washing, rubbing and perspiration using myrobolan: nickel sulphate combination in aqueous medium is presented in Table 1. All the treated samples subjected to light show fairly good (3-4) light fastness for all mordant combinations. The wash fastness grades range between 3 and 4 for all of the treated samples and there is no colour staining observed.

The colour change to dry and wet rubbing for all the treated samples is found to be excellent (5). There is a variation from no colour staining to negligible colour staining (5 to 4-5) in dry rubbing. Most of the treated samples show excellent fastness grade to colour change in both acidic and alkaline media. There is no colour staining (5) observed for all the treated samples in both acidic and alkaline media (Table 1).

The colour fastness and colour strength values obtained by the earlier researchers were compared to that of cotton fabrics dyed using combination of mordants such as 1 : 3, 1 : 1 and 3 : 1. In all the three methods of dyeing using three plant parts, the mordants ferrous sulphate and aluminium sulphate showed excellent results.

It is interesting to note that among the three combinations 1 : 3 mordant concentration gave better results. Comparing the three dyeing methods, simultaneous method gave excellent results with all the three natural dyes and it is reported in Table 1

Similar fastness properties were reported by Sandeep bains et al (2005) and Samanta et al (2007) in premordanting method with combination of salt mordants.

A better perspiration fastness value was observed in the present study compared to Patel [15] when aluminium sulphate ($\text{PF}_{\text{acidic}} : 1$; $\text{PF}_{\text{alkaline}} : 1-2$) and ferrous sulphate ($\text{PF}_{\text{acidic}} : 2$; $\text{PF}_{\text{alkaline}} : 2-3$) were used as mordants. Copper sulphate mordanted henna leaves dyed with cotton gives a higher colour strength (CS : 8.0) reported by Javed iqbal et al [16] when compared with the present study ($\text{CS}_{\text{max}} : 3.26$) in premordanting method.

Table 1 Comparison of fastness properties and colour strength of dyed cotton using combination of mordants

Plant parts used for dyeing	Mordant used	Method	Properties						Reference	
			WF	LF	RF		PF			CS (K/S)
					Dry	Wet	Acidic	Alkaline		
Flower of <i>Spathodea campanulata</i>	MB : AS (1 : 3)	SM	4	4	5	5	4	4	3.15	Present study
		PM	5	3-4	4-5	4	5	5	2.79	
	MS :FS (1 : 3)	SM	5	4	5	5	4-5	4	3.26	
		PM	4-5	3-4	4-5	4-5	5	5	2.88	
Flower of <i>Cordia sebestena</i>	MB : AS (1 : 3)	SM	4-5	4	5	5	4	4	2.99	
		PM	5	4	5	5	5	5	2.85	
	MS :FS (1 : 3)	SM	5	4	4	5	4	4	3.10	
		PM	5	4	5	5	5	5	2.77	
<i>Prunus persica</i> (wool)	CuSO ₄ : FS (1 : 3)	SM	4	4	4-5	4	5	5	-	Sandeep bains et al (2005)
	AS : FS (1 : 3)	SM	4	3-4	5	5	4	4	-	
Henna leaves	Copper sulphate (4%)	PM	3-4	4	4	3-4	-	-	8.0	Javed iqbal et al (2008)
Jack fruit wood	20% MB : 20% AS	PM	4	3	4	3-4	-	-	3.35	Samanta et al (2007)
	20% MB : 20% FS	PM	3-4	1	4-5	3-5	-	-	3.99	
<i>Morinda tinctoria roxb.</i>	Aluminium sulphate	PM	4	3-4	4-5	4	1	1-2	-	Patel (2011)
	Ferrous sulphate	PM	4	4	4-5	4	2	2-3	-	

WF-Wash fastness LF-Light fastness PF-Perspiration fastness RF-Rub fastness CS-Colour strength CuSO₄-Copper sulphate PM-Pre mordanting SM-Simultaneous mordanting MB - Myrobolan FS -Ferrous sulphate AS- Aluminium sulphate

CONCLUSION

Comparing the fastness properties and colour strength of the dyed cotton fabric using various combination of mordants, simultaneous mordanting method with 1 : 3 mordant combination gives better results. Of the two natural dyes *Spathodea campanulata* gives better colour strength and fastness properties.

Acknowledgement

The author is thankful to Mr P Santharaj, Department of Textile Processing, Erode Institute of Technology for his support in the analysis of fastness properties of the dyed samples of this work.

REFERENCES

- [1] B.Anderson; Creative spinning, weaving and plant dyeing, Angus and Robinson, Singapore, **1971**, 24-28.
- [2] A.K.Samanta; Agarwal Priti; Datta Siddhartha; *Indian Journal of Fibre and Textile Research*, **2007**, 32, 466-476.
- [3] Sandeep bains; Sumeet kang; Koshal preet kaur; *Journal of the Textile Association*, **2005**, 127-131.
- [4] Sandeep Bains; O.P.Singh; Ganganpreet Goraya; Manpreet Kang; *Journal of the Textile Association*, **2003**, 183-186.
- [5] M.L.Gulrajani; Gupta Deepti; Department of Textile Technology, IIT, Delhi,**1992**, 10-25.
- [6] Thomas Bechtold; R.Mussak; A.Mahamud Ali; E.Ganglberger; Geissler; *J. Sci. Food Agric.*,**2006**,86,233-242.
- [7] P.E.Kumar; M.Kumaresan; T.S. Boopathi; Bharathiar University, Coimbatore,**2004**.
- [8] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *Nature Environment and Pollution Technology*, **2010**, 9(3), 547-552.
- [9] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *Journal of Asian Scientific Research*, **2011**, 1(4), 137-142.
- [10] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *The Asian Journal of Experimental Chemistry*, **2011**, 6(1), 1-7.
- [11] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *Journal of Natural Product and Plant Resources*, **2012**, 2(1), 32-38.
- [12] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *Indian Journal of Fibre & Textile Research*, **2012**, 37,194-198.
- [13] M.Kumaresan; P.N.Palanisamy; P.E. Kumar; *International Journal of Research in Pharmaceutical and Biomedical Sciences*, **2012**, 3(4), 1614-1620.
- [14] M.Kumaresan; *Journal of Environmental Nano Technology*, **2014**, ISSN: 2279-0748, 3(2), 194-199.
- [15] A.R.Patel; *Life sciences Leaflets*, **2011**,19, 88-792.
- [16] Javed iqbal; I.A. Bhatti; S.Adeel; *Indian Journal of Fibre and Textile Research*, **2008**, 33, 157-162.