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Cassia tora Gum- A Thickener for Screen Printing on Silk with *Kachnar* Bark Dye

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Abstract:
The art of printing with natural dyes has played an important role in beautifying the textiles, since time immemorial. But with the introduction of synthetic dyes the use of natural dyes gradually went out of existence due to the fact that brilliant colour and shades with good fastness can be produced with synthetic dyes in lesser time. With the increased awareness of people about harmful effects of synthetic dyes, use of natural dyes as an alternative source again geared up. Nowadays fabrics dyed and printed with natural dyes are in more demand amongst the green minded and health conscious consumers. Keeping in view the importance of natural dyes in textile world a study was conducted to print silk fabric with kachnar bark dye using Cassia tora gum. Eight percent dye was extracted by boiling in water and strained to get dye extract. Extracted dye was evaporated to make 10 ml. dye concentrate. Two concentrationsi.e. 2.5 and 5 % of Cassia tora gum powder was used as natural thickener. Copper sulphate and ferrous sulphate were used as mordants. Printing was done by screen printing technique. Printed samples were dried in sun, cured for three days and steamed in laboratory steamer. The printed samples were evaluated visually for depth of colour, evenness of print, sharpness of print and overall appearance.Fastness of printed samples was studied against, sunlight, washing, rubbing and perspiration using standard test methods. Good prints were obtained with screen. Results of the study revealed that for visual evaluation all the printed samples scored very good scoring 3.82 to 4.4. The fastness ratings against different agencies ranged from fairly good (3/4) to excellent (5). The fastness as well as visual evaluation grades of Cassia tora gum were comparable with guar gum used as controlled thickener, hence cassia tora gum can be used effectively for printing of silk.

Keywords: *Screen printing, Kachnar bark, Cassia tora, Thickener, Visual evaluation, Fastness.*

1. Introduction

The use of dye stuffs to beautify textile materials is as old as textiles themselves and pre-dates written history. Dyes are obtained from two main sources; the natural dyes and synthetic dyes. Natural dyes can be defined as those organic materials that have the ability to impart colour to any substrates which they must have had affinity for. Natural dyes are biodegradable and very compatible with the environment. They have beauty and depth of colour that cannot quite be obtained with synthetics. These dyes can be obtained either from plants, animals, and minerals. Until the mid-19th century, all dyestuffs were made from natural materials, mainly vegetables matter. But with the invent of synthetic dyes in 1856, there was a rapid decline in the use of natural dyes for dyeing and printing of textiles.

Common use of synthetic dyes and thickeners in textile industry will cause rapid pollution to earth and serious ecological problems in future. The best industry is one that pollutes the earth the least. In the recent years concern for environment has created an increasing interest in eco-friendly, biodegradable and nontoxic rational products. Natural dyes and printing can exhibit better biodegradability and generally have a higher compatibility with environment. Natural dyes and natural thickening agents appear to be ideal choice for consumers with eco concern. This is because natural dyes and thickening agents have better biodegradability and higher compatibility with environment (Babel and Gupta, 2013).

Silk is a unique animal protein fibre and enjoys a special position, because of its properties. It is highly moisture absorbent and stands next to wool among all textile fibres in wrinkle recovery. It is the most beautiful of all natural fibres, acclaimed as the queen of natural textiles. It combines strength and durability with beauty, softness, suppleness, cleanliness, lightness and luster. Combined set

of aesthetic properties makes it useful for high fashion luxury textile good. Silk has a natural affinity for dyes, probably because of the good penetrability. Various types of natural dyes can be applied on silk with different mordants producing wide range of colours. All these desirable qualities in silk make it suitable for apparel purposes. Silk is used extensively in luxury fabrics, apparel and home furnishings and in accessories as well (Needles, 2001; Vatsala, 2003).

The objective of present study is to carry out screen printing with the natural dye and natural thickening agent on silk fabric and evaluate the colour fastness properties.

2. Materials and Methods

- Selection of Dye: *Kachnar (Bauhinia variegate)* bark was used for printing on silk fabric. The bark was dried in shade and ground to make powder.
- Selection of Gum: *Cassia tora* gum was used as thickener for printing. Guar gum (commercial gum) was used as control for comparison.
- Printing Techniques: Screen printing technique was used.
- Mordants and Mordant Concentration: Metal salts were used to provide exhaustion and fixation for printing paste to textile materials. Ferrous sulphate and copper sulphate were used as mordants and1 percent concentration of both the mordants was used.
- Preparation & Pretreatment of fabrics: Plain off white *khadi* silk fabric was purchased from market. Degumming of fabric was done using 2gm/lt. neutral soap to remove the impurities. Degummed fabric was pretreated with 20 percent myrobalan solution for 24 hours maintaining the 1:20 MLR (material to liquor ratio). The fabric was squeezed and sun dried. The side exposed to sunlight was darker and was used for printing.
- Extraction of dye and preparation of dye concentrate: 8 percent dye material was soaked overnight and dye was extracted in aqueous medium after boiling for 60 minutes. The extracted dye solution was boiled to form 10 ml. dye concentrate.
- Preparation of thickener and printing paste: Two concentrationsi.e. 2.5 and 5 % of *Cassia tora,* and guar gum powder were used as thickener and a smooth paste was prepared for printing.
- Printing: Printing process was carried out using silk screen. After printing the samples were shade dried.
- Steaming: Printed, dried samples were subjected to steaming treatment in laboratory steamer at 100^0C for half an hour.
- After treatment: Printed samples were treated with alum (Aluminium potassium sulphate) for 30 min. at room temperature for dye fixation.

2.1. Testing of Printed Samples

2.1.1. Visual Evaluation of Printed Samples

The printed samples were got evaluated visually from ten respondents for depth of colour, evenness of print, sharpness of print and overall appearance.

2.1.2. Fastness Properties of Printed Samples

Fastness properties of printed samples against washing, sunlight, rubbing (dry and wet) and perspiration (acidic & alkaline) were tested as per standard test methods of IS: 3361-1979, IS:686-1957, IS:767-1956 and IS:971-1956 methods respectively. Light fastness ratings were given as per blue wool standards and samples of washing, rubbing and perspiration fastness were assigned ratings for change in colour and degree of staining on standard fabric with the help of grey scales.

3. Results and Discussions

S. No.	Gum/ Mordant Conc.	Aggregate Mean Score
1.	Guar gum 2.5%	4.22
2.	*Cassia tora* gum 2.5%	3.82
3.	$CuSo_4$ 1%	4.0
4.	$FeSo_4$ 1%	4.35
5.	Guar gum 5%	3.92
6.	*Cassia tora* gum 5%	3.92
7.	$CuSo_4$ 1%	4.3
8.	$FeSo_4$ 1%	4.4

Table 1: Visual evaluation of samples printed with kachnar bark dye(n=10)

The data regarding visual evaluation of screen printed samples presented in Table-1 depicted that samples printed with 2.5% guar gum scored higher i.e. 4.22 as compared to *Cassia tora* gum scoring 3.82. Though the scoring of samples printed with guar gum thickener was very good but the results of *Cassia tora* thickener were also in acceptable range i.e. scoring was very good to good. In case of printing with 5% guar gum and *Cassia tora* gum thickeners the scores for visual evaluation were same i.e. 3.92. After mordanting with copper sulphate and ferrous sulphate the scores for visual evaluation were higher as compared to control sample. Hence it can be concluded that use of mordants in printing improved the visual appearance of prints.

Gum Conc.	Mordant Conc.	Colour Fastness Grades													
		Sun light	Washing			Rubbing				Perspiration					
			CC	CS		Dry		wet		Acidic			Alkaline		
				S	C	CC	CS	CC	CS	CC	CS		CC	CS	
											S	C		S	C
Guar Gum 2.5%	---	5	4	5	4	5	4	4	3/4	4	4	3/4	4	4	3/4
Cassiatora gum 2.5%	---	5	4	5	4/5	5	4/5	4	3/4	4/5	4	4	3/4	4	3/4
	$CuSo_4$ 1%	4/5	4	4/5	4	4/5	4/5	4/5	4	4	4/5	3/4	3	4/5	4
	$FeSo_4$ 1%	4*	4/5	5	4	4/5	3	4	3	3/4*	4	3/4	4/5*	5	4
Guar Gum 5%	--	4/5	4	4/5	4	4/5	4	4/5	4	3/4	4/5	4	4	4/5	3/4
Cassiatora gum 5%	--	4/5*	4	4/5	3	4	3	3/4	3/4	4	4	3	4	4	3/4
	$CuSo_4$ 1%	4/5	3/4	4/5	3/4	4	3	3/4	3	3	4	3/4	4	4	3
	$FeSo_4$ 1%	4/5*	4/5*	4/5	4	4	3	3/4	3/4	3/4	4/5	3/4	4	4/5	4

Table 2: Colour fastness of samples printed with kachnar bark dye
**Brightness improved*

The data presented in Table 2 revealed that sunlight fastness of samples printed with 2.5% guar gum was excellent (5) whereas the fastness grades for washing, rubbing and perspiration ranged between fairly good to excellent (3/4 to 5). The data regarding screen printed samples with 2.5% *Cassia tora* gum depicted that sunlight fastness was excellent (5). Grades for washing, rubbing and perspiration fastness tests ranged between 3/4 to 5 i.e. fairly good to excellent. Hence it can be concluded that both the thickeners produced same prints. After mordanting slight change was observed in fastness properties against different tests and the grades 3 to 4/5 i.e. fairly good to very good however in case of few ferrous sulphate mordanted samples the brightness of colour improved after subjecting to alkaline solution.

Screen printed samples using 5% guar gum thickener had very good (4/5) fastness against sunlight whereas the results of other fastness tests i.e. washing, rubbing and perspiration ranged between fairly good to very good (3/4 to 4/5). The data regarding fastness properties of screen printed samples with 5% *Cassiatora* gum thickener revealed that sunlight fastness was very good (4/5*) with improvement in brightness of colour. Whereas the results of other fastness test i.e. washing, rubbing and perspiration ranged between fairly good to very good (3/4 to 4/5). After mordanting grades for fastness properties against different tests were comparable with those of commercial gum however in case of few ferrous sulphate mordanted samples the brightness of colour improved after subjecting to alkaline solution.

4. Conclusion

The results of the study revealed that silk fabric can successfully screen printed using gum extracted from *Cassia tora* with Kachnarbark dye extract. Printed fabric exhibited good to excellent colour fastness properties towards sunlight, dry and wet rubbing, washing and acidic and alkaline perspiration. It can be concluded that *Cassia tora* gum thickened printing paste can be safely used for screen printing of silk.

5. References

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Annexure

 Guar gum (2.5%)	 Guar gum (5%)
 *Cassia tora* gum (2.5%)	 *Cassia tora* gum (5%)
 *Cassia tora* gum (2.5%) + Copper Sulphate 1%	 *Cassia tora* gum (5%) + Copper Sulphate 1%
 *Cassia tora* gum (2.5%) + Copper Sulphate 1%	 *Cassia tora* gum (5%) + Copper Sulphate 1%

Figure 1: Printed Samples