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Mango Kernel Starch- A Natural Thickener for Screen Printing on Silk With Kachnar Bark Dye

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ABSTRACT

Dyes are being widely used for embellishing textiles and in ancient times natural dyes were being used vastly for the purpose. But with the invention of synthetic dyes the use of natural dyes gradually went into oblivion as bright colours and shades with good fastness can be obtained with synthetic dyes in lesser time. Nowadays once again with the increased awareness of people about harmful effects of synthetic dyes, use of natural dyes as an alternative source geared up. Green minded and health conscious consumers go for fabrics dyed and printed with natural dyes. Keeping in view the importance of natural dyes in textile world a study was conducted to print silk fabric with kachnar bark dye using mango kernel starch. Eight percent dye was extracted by boiling in 100 ml. water and strained to get dye solution. Extracted dye solution was boiled and evaporated to make 10 ml. dye concentrate. Two concentrations i.e. 2.5% and 5 % of Mango kernel starch 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 printing. Results of the study revealed that for visual evaluation all the printed samples scored very good scoring 3.92 to 4.47. The fastness ratings against different fastness tests ranged from fair (2/3) to excellent (5). The fastnesses as well as visual evaluation grades of Mango kernel starch were comparable with guar gum used as controlled thickener; hence concluded that mango kernel starch can be used effectively for printing of silk.

KEYWORDS : Screen printing, Kachnar bark, Mango kernel starch, Thickener, Visual evaluation, Fastness.

Introduction

The art of dyeing and printing has played an important role in adding beauty to the textile world. Dyeing is the art of imparting particular hues and tints to yarn, fabric and other material by employing coloring matter whereas, in printing, design and colour forms an artistic expression to embellish the fabric. Dyes are obtained from two main sources; natural sources and synthetic sources. Natural dyes can be defined as those organic materials that have the ability to impart colour to any substrates which they must have 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 synthetic dyes. 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 the invention of synthetic dyes in 1856 drove the use of natural dyes in oblivion.

Common use of synthetic dyes and thickeners in textile industry is causing rapid pollution to earth and it will lead to serious ecological problems in future. In the recent years concern for environment has created an increasing interest in eco-friendly, biodegradable and non toxic rational products. Natural dyeing 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. (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. 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).

Hence, keeping in view the importance of natural dyes in apparel and textile industry the present study was carried out with an objective: Screen printing with the natural dye and natural thickening agent on silk fabric and to evaluate the colour fastness properties.

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 dye powder.

Selection of Thickener: Mango kernel starch was used as thickener for printing. Guar gum (commercial gum) was used as controlled thickener 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 and 1 percent concentration of both the mardants 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 in 100 ml. water 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 concentrations i.e. 2.5% and 5 % of *Mango kernel starch* and same concentrations i.e. 2.5% and 5% of guar gum powder were used for making smooth thickener pastes for printing.

Printing: Printing process was carried out on pretreated silk fabric using screens. After printing the samples were shade dried.

Steaming: As steaming is very important in printing process for dye

fixation. So, printed, dried samples were subjected to steaming treatment in laboratory steamer at 100ºC for half an hour.

After treatment: Printed samples were treated with alum (Aluminium potassium sulphate) for 30 min. at room temperature for dye fixation.

Testing of printed samples

Visual evaluation of printed samples

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

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 washing, rubbing and perspiration fastness grades were assigned for change in colour and degree of staining on standard fabric with the help of grey scales.

Results and Discussions

Table: 1 Visual evaluation of samples printed with *kachnar* bark dye

n=10

S. No.	Gum/ Mordant Conc.	Aggregate Mean Score
1.	Guar gum 2.5%	4.22
2.	*Mango kernel starch* 2.5%	4.22
3.	$CuSo_4$ 1%	4.15
4.	$FeSo_4$ 1%	4.40
5.	Guar gum 5%	3.92
6.	*Mango kernel starch* 5%	4.22
7.	$CuSo_4$ 1%	4.37
8.	$FeSo_4$ 1%	4.47

The data regarding visual evaluation of screen printed samples presented in Table-1 depicted that samples printed with 2.5% guar gum and *Mango kernel starch* scored same i.e. 4.22. In case of printing with 5% guar gum and *Mango kernel starch*, the scores for visual evaluation for Mango kernel starch were better i.e. 4.22 as compared to guar gum printed samples 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. The results are supported by Pruthi et.al. (2008) and Pruthi et.al. (2011) as in their study they concluded that addition of metallic salts/ mordants improve the visual appearance of dyed as well as printed samples.

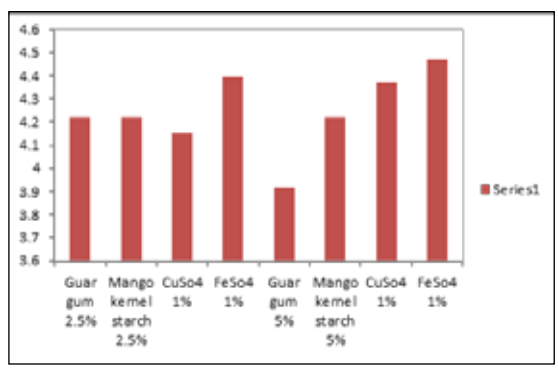

Table 2: Colour fastness of samples printed with *kachnar* bark dye

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 S	CS C	CC	CS S	CS C
Guar Gum 2.5%	---	5	4	5	4/5	5	4/5	4	3/4	3/4	4	3/4	4	4/5	4
Mango kernel starch 2.5%	---	5*	3	4	3	5	4/5	4/5	3	3/4	4	3	3	3	3
	$CuSo_4$ 1%	5	4	5	3	5	3/4	4/5	2/3	4	3/4	2/3	4/5	4	3
	$FeSo_4$ 1%	5*	4/5	4/5	3	4/5	3	4	2/3	4/5	4	3	5	4	3
Guar Gum 5%	--	4/5*	4*	4/5	4	5	4	4/5	4	4	4/5	3/4	4	4	3/4
Mango kernel starch 5%	--	5	4	4/5	3	5	4/5	4/5	3	4/5	4	¾	4/5	4	3
	$CuSo_4$ 1%	5	4	4/5	3	5	4/5	4/5	3/4	4	4	¾	4/5	4	3
	$FeSo_4$ 1%	5*	4/5	4	2/3	5	4/5	4	3	5*	4/5	3/4	5	4/5	3

*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% *Mango kernel starch* depicted that sunlight fastness was excellent (5*) and colour became darker after exposure to Sunlight. Grades for washing, rubbing and perspiration fastness tests ranged between 3 to 5 i.e. fair 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 ranged from 2/3 to 5 i.e. fair to excellent, 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 excellent (3/4 to 5). The data regarding fastness properties of screen printed samples with 5% Mango kernel starch revealed that sunlight fastness was excellent (5). Whereas, the results of other fastness tests i.e. washing, rubbing and perspiration ranged between fair to very good (3 to 4/5). After mordanting grades for fastness properties against different tests were comparable with those of commercial gum i.e guar gum and in case of few ferrous sulphate mordanted samples the brightness of colour improved after subjecting to sun light and alkaline solution. Agarwal et. al. concluded the same results as use of mordants in printing improved the fastness properties of printed samples.

Conclusions:
The results of the study revealed that Mango kernel starch can be successfully used for screen printing on silk fabric with *Kachnar* bark dye extract.

Printed fabric exhibited good to excellent colour fastness properties towards sunlight, dry and wet rubbing, washing and acidic and alkaline perspiration.

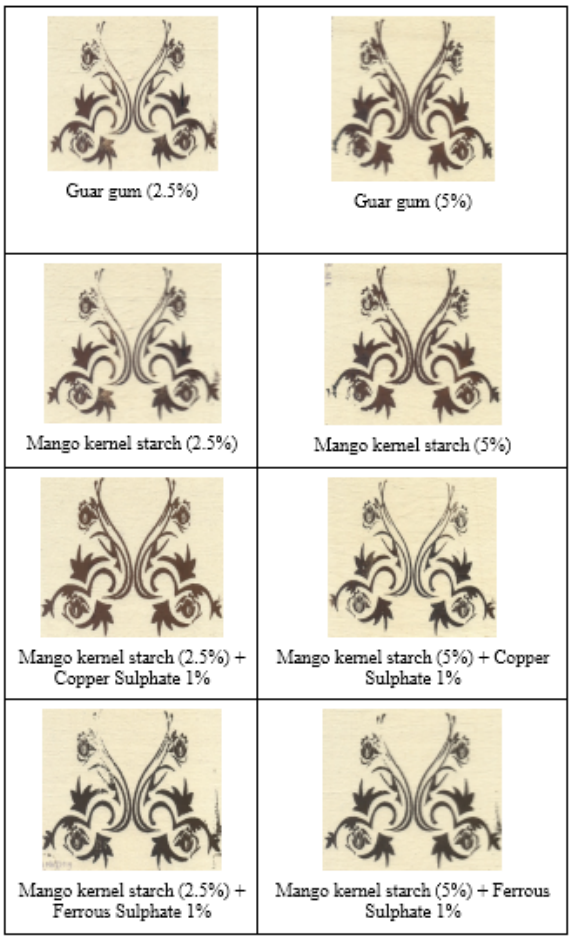

Plate –I Printed Samples

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