

# Eco friendly printing of cotton with *Kachnar* bark dye

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■ **ABSTRACT** : Textile printing involves the production of a predetermined coloured pattern on a fabric, usually with a definite repeat. In India dyeing and printing with natural dyes is an age old practice. Today's scene of natural dye promotion is very optimistic and promising. The scientists and textile technologists of various institutions have started working on natural dyes as a possible means of producing ecologically sound products which would appeal to green minded consumers. Keeping in view the importance of natural dyes in textile world a study was conducted to print cotton fabric with *kachnar* bark dye using *Cassia tora* gum. Cotton fabric was scoured to remove impurities. Dried *kachnar* bark was grounded to make powder, 8 per cent dye was extracted by boiling in water, strained to get dye extract. Extracted dye was evaporated to make 10 ml. dye concentrate. Two concentrations i.e. 2.5 and 5 per cent of *Cassia tora* gum powder was used as natural thickener. Paste of thickener was prepared by adding lukewarm water and added to dye concentrate for making printing paste. Copper sulphate and ferrous sulphate were used as mordants. Printing was done by block and screen printing techniques. 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. Results of the study revealed that for visual evaluation screen printed samples scored higher as compared to block printed samples. The fastness ratings against different agencies ranged from good (3) to excellent (5). The fastnesses 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 cotton.

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■ **KEY WORDS**: Printing, *Kachnar* bark, *Cassia tora*, Mordant, Thickener, Visual evaluation, Fastness

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Ever since clothes were developed people have found ways to enhance their own appearance and express beauty by adorning or decorating their garments. Today also most of the individuals still think of clothes as more than just body coverings. The clothes,

which people wear, reflect their concern with appearance and dyeing and printing adds life to their adornment. 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 colouring matter, whereas in printing design and colour forms an artistic expression to embellish the fabric which has a motif, pattern or design by application of dyes.

In India dyeing and printing with natural dyes is an age old practice. The art and craft to beautify the textiles was being practiced in every corner of our country by expert craft persons. It is believed that the process of printing with natural dyes has been in practice from as long as the 10<sup>th</sup> century (Lal, 1994 and Mishra, 2000). Colourants were extracted from the roots, bark, seeds, leaves, flowers and fruits of various plants and dried bodies of certain insects and shellfish (Singh, 2000). Natural dyes are also known for their soft, lustrous colours and endurance. Even after a long period they retain a great beauty and charm. Originating from natural sources, these do not create any pollution problem and in some cases, the 'waste' obtained in the process becomes an ideal fertilizer for use in agricultural fields. Another very important factor in favour of natural dyes is their aesthetic appeal (Verma and Gupta, 1994 and Gulrajani, 1999).

With the growth of civilization and technological advancement the needs of people increased. To fulfill the requirement of the society, industrial revolution took place as a result there was an influx of synthetic dyes in 1856 which marked the first step in the decline of natural dyes. However production of synthetic dyes involves carcinogenic chemicals which are highly hazardous. On the other hand natural dyes are non hazardous, biodegradable and have better compatibility with environment. With the increasing awareness of people regarding health hazards caused by synthetic dyes and ecological considerations, revival of natural dyes is in vogue. Today's scene of natural dye promotion is very optimistic and promising. The scientists and textile technologists of various institutions have started working on natural dyes as a possible means of producing ecologically sound products which would appeal to green minded consumers. Keeping in view the importance of natural dyes in textile world a study was conducted to print cotton fabric with *kachnar* bark dye using *cassia tora* gum.

## ■ RESEARCH METHODS

### Selection of dye:

*Kachnar* (*Bauhinia variegata*) bark was used for

printing on cotton 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:

Block and screen printing techniques were used.

### Mordants:

Ferrous sulphate and copper sulphate were used as mordants.

### Mordant concentration:

1 per cent concentration of both the mordants was used.

### Preparation and pre-treatment of fabrics:

Desizing of cotton fabric was done and desized fabric was pre treated with myrobolan solution for better colour fixation.

### Extraction of dye and preparation of dye concentrate:

8 per cent 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 concentrations *i.e.* 2.5 and 5 per cent 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 on cotton fabric using wooden blocks and screen. After printing the fabrics were shade dried.

### Steaming:

Printed, dried samples were subjected to steaming treatment in laboratory steamer at 100°C 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 respondents 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 and 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.

## ■ RESEARCH FINDINGS AND DISCUSSION

The data presented in Table 1 regarding visual evaluation of samples printed with *kachnar* bark dye using 2.5 per cent guar gum indicated that screen printed samples scored higher *i.e.* 4.9 as compared to block printed samples scoring 3.52. With the use of *Cassia tora* gum as thickener again screen printed samples scored higher *i.e.* 3.47 as compared to block printed samples scoring 3.12. However ratings of samples printed with guar gum were higher as compared to *Cassia tora* gum but within acceptable range. When the samples mordanted with copper sulphate and ferrous sulphate with *Cassia tora* indicated better appearance *i.e.* 4.1 and 4.12, respectively as compared to block printed samples scoring 3.92 and 3.8.

Printing with 5 per cent guar gum indicated that screen printed samples scored higher *i.e.* 3.25 as compared to block printed samples scoring 3.22. With *Cassia tora* gum also screen printed samples scored higher *i.e.* 3.8 as compared to block printed samples scoring 3.2. When mordanted with copper sulphate and ferrous sulphate with *Cassia tora* showed better appearance *i.e.* 4.25 and 3.42, respectively as compared to block printed samples scoring 3.87 and 3.6.

All the mordanted samples scored higher ranks for visual evaluation, it may be due to the reason that with the use of mordant there was variation in shade and hence the overall appearance of design appeared better.

The data presented in Table 2 regarding fastness properties of cotton samples printed with *kachnar* bark dye using 2.5 per cent guar gum depicted that for block printed samples sunlight fastness was excellent scoring 5. The grades for change in colour after washing showed good fastness (4) while colour staining on the adjacent fabrics was negligible. Fastness grades for rubbing and perspiration fastness also ranged between excellent to very good.

Fastness properties of samples printed with 2.5 per cent *Cassia tora* gum revealed that for block printed samples fastness to sunlight was very good (4/5\*) and brightness of colour improved after exposure to sunlight whereas other fastness properties ranged between fair to excellent *i.e.* scoring 3 to 5. Samples mordanted with copper sulphate and ferrous sulphate showed very good fastness against sunlight (4/5\*) with improvement in brightness of colour after exposure to sunlight. For other properties *i.e.* washing, rubbing and perspiration the grades ranged between fair to excellent *i.e.* scoring 3 to 5, ferrous sulphate mordanted samples showed improvement in brightness of colour after washing.

Results of block printed samples using 5 per cent guar gum showed that sunlight fastness was excellent (5), washing, rubbing and perspiration fastness grades ranged between fairly good to excellent (3/4 to 5).

Fastness grades of block printed samples with 5 per cent *Cassia tora* gum showed excellent (5) sunlight fastness whereas results of other tests ranged between fair to excellent (3 to 5). After mordanting with copper sulphate and ferrous sulphate the colour fastness grades against different agencies *i.e.* sunlight, washing, rubbing and perspiration ranged between fair to very good (3 to 4/5). However after mordanting with ferrous sulphate brightness of colour improved when tested for fastness against washing and perspiration. Goel and Chauhan (1996) printed cotton fabric with Manjistha dye and reported that use of mordants in printing made the colour faster and brighter after washing.

Guar gum 2.5 per cent the data regarding fastness properties of screen printed samples revealed that sunlight fastness was excellent (5) whereas the results of other fastness tests *i.e.* washing, rubbing and perspiration ranged between fairly good to excellent (3/4 to 5).

*Cassia tora* 2.5 per cent The data regarding screen printed samples depicted that sunlight fastness was very

good (4/5\*) and colour changed towards darker side. Grades for washing, rubbing and perspiration fastness tests ranged between 3 to 4/5 *i.e.* fair to very good. After mordanting sunlight fastness was again very good (4/5\*) and fastness to other tests ranged from fair to very good (3 to 4/5). In case of few ferrous sulphate mordanted samples colour changed towards darker side.

5 per cent guar gum the data regarding fastness properties of screen printed samples revealed that sunlight fastness was very good (4/5\*) with improvement

in brightness of colour. Whereas the results of other fastness tests *i.e.* washing, rubbing and perspiration ranged between fairly good to excellent (3/4 to 5).

5 per cent *Cassia tora* Fastness properties of screen printed samples revealed that sunlight fastness was very good (4/5\*) with improvement in brightness of colour. Whereas the results of other fastness tests *i.e.* washing, rubbing and perspiration ranged between fairly good to excellent (3/4 to 5). After mordanting with copper sulphate and ferrous sulphate sunlight fastness was

Sr. No.	Gum/ Mordant Conc.	Aggregate mean score	
		Block printed	Screen printed
1.	Guar Gum (2.5%)	3.52	4.9
2.	<i>Cassia tora</i> Gum (2.5%)	3.12	3.47
3.	CuSO <sub>4</sub> 1%	3.92	4.10
4.	FeSO <sub>4</sub> 1%	3.8	4.12
5.	Guar Gum 5%	3.22	3.25
6.	<i>Cassia tora</i> Gum 5%	3.2	3.8
7.	CuSO <sub>4</sub> 1%	3.87	4.25
8.	FeSO <sub>4</sub> 1%	3.6	3.42

Gum Conc.	Mordant Conc.	Colour fastness grades													
		Sun light	Washing				Rubbing				Perspiration				
			CC	CS		Dry	wet		CC	Acidic		CC	Alkaline		
				W	C		CS	CC		CS	CC		W	C	
Guar gum 2.5%	---	5	4	5	4/5	5	4/5	4	4	4	4/5	4	4	4/5	4
<i>Cassia tora</i> gum 2.5%	---	4/5*	3	5	4/5	4/5	4/5	4	4	4/5	5	4	3	4/5	4/5
	CuSO <sub>4</sub> 1%	4/5*	4	5	4	4/5	4/5	4/5	4	4/5	4/5	3/4	3	4/5	4/5
	FeSO <sub>4</sub> 1%	4/5*	4/5*	4/5	4/5	4/5	4/5	4	4	3/4	4/5	4	4	4/5	4
Guar gum 5%	---	5	4	5	4/5	5	4	4	4	3/4	5	4	4	4/5	4
<i>Cassia tora</i> gum 5%	---	5	4	5	4	4/5	4/5	4	4	4	4/5	3	4	4	3/4
	CuSO <sub>4</sub> 1%	5	4	5	4	4/5	4/5	4	4	4	4/5	3	4	4	3/4
	FeSO <sub>4</sub> 1%	5	4/5*	5	4/5	4/5	4/5	4	4	4	5	4	4/5*	4/5	4

\*Brightness improved

Gum Conc.	Mordant Conc.	Colour fastness grades													
		Sun light	Washing				Rubbing				Perspiration				
			CC	CS		Dry	wet		CC	Acidic		CC	Alkaline		
				W	C		CS	CC		CS	CC		W	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
<i>Cassia tora</i> gum 2.5%	---	4/5*	4	4/5	4	4/5	4/5	4/5	4	4	4/5	3/4	3	4/5	4
	CuSO <sub>4</sub> 1%	4/5*	4/5	5	4	4/5	4/5	4	4	4/5	4/5	3/4	3	4/5	4
	FeSO <sub>4</sub> 1%	5*	4*	4/5	4	4/5	4/5	4	4	3/4	4/5	3/4	4*	4/5	4
Guar gum 5%	---	4/5*	4*	4/5	4	5	4	4/5	4	4	4/5	3/4	4	4	3/4
<i>Cassia tora</i> gum 5%	---	4/5*	4*	4/5	4	5	4	4/5	4	4	4/5	3/4	4	4	3/4
	CuSO <sub>4</sub> 1%	4/5	4	4/5	4	4/5	4/5	4/5	3/4	4	4/5	3	4	4	3/4
	FeSO <sub>4</sub> 1%	5	4/5*	4/5	4	4/5	4/5	4/5	4	4	4	3/4	4/5*	4/5	4

\*Brightness improved

excellent and other fastness tests ranged between 3/4 to 4/5 *i.e.* fairly good to very good. Ferrous sulphate mordanted samples showed improvement in colour after washing and perspiration tests. Aggarwal (2000) worked on screen printing of cotton fabric with natural dyes and reported that fastness of printed samples improved with the use of mordants. Similar work related to the present investigation was also done by Gulrajani *et al.* (1993); Paul *et al.* (1996); Gogoi and Gogoi, (2016); Kalsy and Srivastava (2015); Dhanalaxmi and Vastrad (2015); Sudhakar and Ninge Gowda (2005); Deka *et al.* (2014); Phukon (2014); Duarah and Kaur (2014); Sharma *et al.* (2014) and Kale and Naik (2015) and .

### Conclusion :

– On the basis of visual evaluation and colour fastness tests of the samples printed with *kachnar* bark dye using *Cassia tora* gum revealed that overall screen printed samples were adjudged better as compared to block printed samples.

– Mordanted samples were adjudged better as compared to unmordanted samples, though the difference was negligible.

– *Cassia tora* gum is an acceptable thickener for printing of cotton fabric.

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