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Research Paper

Printing of cotton fabric with Catechu bark

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■ **ABSTRACT :** The study was to explore the printing of cotton fabric with natural dyes extracted from catechu bark. The printing receipe was standardized using different variables *viz.*, extraction pH, dye paste, pH of guar paste, dye paste and guar paste ratio, fixer concentration and mordant concentration. Copper sulphate and ferrous sulphate were used as mordants and colour fastness properties of printed samples were evaluated. The results indicated that different shades of brown and black were obtained using mordants with excellent washing and sunlight fastness. It was observed that washing made colour brighter and faster.

■ **KEY WORDS:** Printing, Cotton fabric, Catechu bark

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The art of dyeing and printing dates back to Indus Valley Civilization. Printed fabrics are defined as fabrics decorated with motif, pattern or design. India is known to have tradition of using natural dyes as it has rich vegetable sources which can be used as dyes. From the immemorial people of India have been weaving, dyeing and printing cotton cloth with natural dyes.

Colors obtained with natural dyes have a harmonic-a-resonance-a -depth that commercial dyes lack. Natural dyes yield to produce lustre, rich colour, aromatic smell, soft and light shades, soothing to human eye and are much used for experimental work. However, the method of extraction of these dyes from natural sources and subsequent process of application of textile material is lengthy. Hence, the use of natural dyes for printing of textiles is very limited (Joseph, 1972).

The non availability of standard printing paste, specific ways of application and standard norms are also responsible for limited use. Hence, keeping the above factors and eco preservation in mind, an attempt has been made to print cotton fabric with selected natural dye material *i.e.* catechu (*Acacia catechu*).

■ RESEARCH METHODS

Catechu cakes used for study were purchased from local market at the rate of Rs. 200/Kg. Pure cotton fabric was used for study and was scoured in a solution containing detergent (2 g/1.) and NaOH (1 g /l.) at boiling temperature for 1-2 hours to remove all the impurities, washed thoroughly and squeezed.

Screen printing technique was used for printing of cotton fabric. Guar gum was used as thickener on the basis of maximum viscosity as compared to other thickeners.

Standardization of printing paste :

Printing paste mainly consisted of two ingredients *i.e.* dye paste and guar paste. It was optimized using

different variables *viz.*, extraction pH, dye paste, pH of guar paste, dye paste and guar paste ratio, fixer concentration and mordant concentration. The dye was extracted using optimum dye material concentration and optimum extraction time taken from review papers (Bhattacharya *et al.*, 1998).

Printing paste were prepared after each variable and samples were printed, dried, steamed and rinsed. Optimum extraction pH, dye paste, pH of guar paste were selected on the basis of visual assessment of printed designs. The dye paste and guar paste ratio, fixer concentration and mordant concentration were optimized on the basis of washing fastness of printed designs.

■ RESEARCH FINDINGS AND DISCUSSION

The present study was conducted to explore the usefulness of catechu dye for printing of cotton fabric to obtain a wide range of colours using different mordants.

In dye extraction pH play an important role as it affects the colour. The visual evaluation of printed samples using different extraction pH are presented in Table 1. It was observed that extraction of dye increased with increasing pH upto 9 and then decreased. Hence, pH 9 was selected as optimum extraction pH. The results indicated that slightly alkaline pH was best for extraction.

Table 1 : Optimization of extraction pH

Extraction pH	6	7	8	9	10
Weighted mean scores	1.6	1.8	2.0	2.9	2.6

Rose (2002) studied optimum pH for extraction and reported that the best results were at alkaline pH for cotton fabric dyed with banyan leaves. Extracted dye solution was concentrated to obtain dye paste which was used to prepare printing paste. The weighted mean scores of printed samples using different dye paste revealed that highest weighted mean score was at 5.0 ml dye paste (100 ml reduced to 5 ml) (Table 2). At this concentrated dye paste the outline of designs were sharp and clear.

Table 2 : Optimization of dye paste

Dye paste (ml)	10	7.5	5
Weighted mean scores	2.2	2.5	2.8

100 ml each reduced to 10, 7.5 and 5 ml, respectively

Guar paste was added to prevent the rapid diffusion of dyestuff through boundaries of design. The results indicated that highest weighted mean score was obtained when pH 6 was maintained for guar paste (Table 3). The samples were also printed with natural pH of guar paste (6.6) but results were better at 6 pH. Hence, slightly acidic pH of guar paste was best for printing.

Table 3 : Optimization of pH of guar paste

pH of guar paste	4	6	8
Weighted mean scores	2.2	2.8	2.0

The printing receipe was standardized using three ratios of dye paste and guar paste. The washing fastness grades of printed samples using different ratios of dye paste and guar paste were evaluated and it was revealed that grades were very good (4/5) at ratio 1:4 (Table 4), *i.e.* when dye paste and guar paste was used in ratio, 1:4. Hence ratio 1:4 was selected for further study.

Table 4 : Optimization of dye paste and guar paste ratio

Sr. No.	Ratio Dye paste : Guar paste	Washing fastness grades CC	CS
1.	1:4	4/5	4/5
2.	1:5	4	4/5
3.	1:6	¾	4/5

CC : Colour change; CS ; Colour staining

Acrafix (fixer) was added to increase the fastness of printed designs. It was observed that washing fastness increased with increasing concentration of acrafix upto 1.5 per cent (Table 5). At this concentration washing fastness grades were excellent. Further increase in acrafix concentration did not reduce fastness much but it was not selected because it led to dullness of colours obtained.

Table 5 : Optimization of fixer concentration

Sr. No.	Per cent concentration*	Washing fastness grades CC	CS
1.	Without fixer	4	4/5
2.	0.5	4	4
3.	1.0	4/5	4/5
4.	1.5	5	5
5.	2.0	4/5	4/5

CC : Colour change; CS ; Colour staining
* on the basis of total paste

Copper sulphate and ferrous sulphate were selected as mordants. The washing fastness grades of catechu printed samples at three different concentrations (3, 5 and 7 %) of both the mordants are presented in Table 6. It is clear from the table that washing fastness grades

were excellent with all the three concentrations of copper sulphate and the lowest *i.e.* 3 per cent was selected as optimum concentration. The washing fastness grades with ferrous sulphate were excellent at 5 per cent concentration. It was also observed that after washing colour became faster and brighter with both mordants. The colours obtained with catechu using copper sulphate and ferrous sulphate were coffee brown and black, respectively (Plate 1).

Goel and Chauhan (1996) also found that washing made colour faster and brighter on cotton fabric printed with *Manjistha*, which are in accordance to the results of the present work.

Plate 1 : Colours obtained with Catechu bark using optimum printing variables

Optimum variables of printing paste:

The different variables of printing paste standardized in work are presented which were used for further work.

Dye material concentration	6 per cent
Extraction time	1 hour
Extraction pH	9
Dye paste	5 ml (100 ml reduced to 5 ml)
pH of guar paste	6
Dye paste : guar paste	1:4
Acrafix	1.5 per cent (on the basis of total paste)
Mordants	3% copper sulphate 5% ferrous sulphate

Colour fastness grades of printed samples :

Colour fastness grades of printed samples against washing, sunlight and rubbing are presented in Table 7.

It was revealed from table that washing fastness grades for colour change and staining were excellent with both the mordants. Washing made colour faster and brighter than that of original samples. The sunlight fastness grades were also excellent indicating slight or no change in colour.

The dry rubbing fastness grades were very good (4/5) with both the mordants ($CuSO_4$ and $FeSO_4$) indicating slight change in colour and staining. The wet rubbing fastness grades were good to very good and fair to very fair for colour staining (Kaur, 1995).

Table 6 : Optimization of mordant concentration for catechu bark

Sr. No.	Mordants	Mordant concentration* (%)	Washing fastness Grades	
			CC	CS
1.	Copper sulphate	3	5	5
		5	5	5
		7	4/5	5
2.	Ferrous sulphate	3	4/5	4/5
		5	5	5
		7	4/5	5

CC : Colour change; CS ; Colour staining * on the basis of total printing paste

Table 7 : Colour fastness grades of catechu printed samples

Mordant	Mordant concentration* (%)	Washing fastness		Light fastness	Rubbing fastness			
					Dry		Wet	
		CC	CS		CC	CS	CC	CS
Copper sulphate	3	5	5	5	4/5	4/5	4	2/3
Ferrous sulphate	5	5	5	5	4/5	4/5	4/5	3
Without Mordant		1/2	2/3	5	4/5	4/5	4/5	4

* on the basis of total paste. CC : Colour change; CS ; Colour staining

Conclusion :

The results of this investigation showed that catechu dye can be effectively used for printing of cotton fabric. Bright shades of brown and black can be obtained using different mordants. The dye can be used by garments and textile industry and designers. Hence, it can be concluded that the use of this dye for printing purpose causes no harm to our ecology.

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