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Research Paper

Utilization of natural printing paste for textile application

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■ **ABSTRACT :** An investigation was carried out to find out the printing effect of turmeric (*Curcuma longa* L.) dye paste on geometrical properties of eri silk fabric. For the experiment, plain weave eri silk fabrics, with different mordants (alum, stannous chloride and ferrous sulphate) were selected. The two traditional designs and screen-printing technique were selected for printing the fabric. The printed samples were evaluated for its geometrical properties. In regard to geometrical properties, all the samples have more or less changes in fabric count, weight and thickness. In respect of the high brilliancy of colour, clarity of design and sharpness of design outline samples mordanted with ferrous sulphate showed the better result in both the designs.

■ **KEY WORDS:** Eco-friendly, Eri silk, Geometrical properties, Mordant, Printing, Turmeric dye

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Colour is an important element that transforms the look of fabric (Dantyagi, 1983). Colours can be added to textiles by means of dyeing or creating designs by printing. Addition of prints on a fabric or garment not only accentuates its beauty but also increases its aesthetic value. Printing of textiles materials is the application of colour according to a predetermined design. The main objective in textile printing is to produce attractive designs with well defined boundaries made by artistic arrangement of motifs in one or more colours. The term textile printing is used to describe the production, by various mechanical and chemical means of coloured designs or patterns on textile substrates (Glover, 2005). Printing is a technique of applying colour to a piece of material via some medium e.g., block, roller and screen, which carries a design. Screen printing method is the most commonly employed method of printing throughout the world. Screen printing can be done either by hand or by an automatic process. The fabric to be printed is spread out on a long table. A screen is prepared for each colour of the design, fine screens of silk were used, and hence the name "Silk Screen Printing" came. But today screens of synthetic fibers on metal mesh are used. Screen printing method is simple to operate and does not require elaborate and expensive equipment. It is economical in production and manually less exhausting than other printing methods. The prints obtained are brighter, intense possessing natural bloom (Corbman, 1976). Dyes used in printing are same as in regular dyeing but instead of the thin dye bath solution thickener combination are necessary for printing. The paste used in textile printing consists of dye, water, hydrocarbon solvent or oil and thickener. Dye is an organic compound responsible for the colour of dyed or printed textile fiber material- a compound fixed on a substance in a more or less permanent state that evokes

the visual sensation of a specific colour. The dyes or dyestuffs are classified depending upon the source from which they are obtained. Turmeric (*Curcuma longa* L.) which is the raw material of natural dye is widely available as a household curry powder and also be utilized as a printing paste. North-eastern region of India has been considered to be the homeland of all the commercially exploited silkworms *i.e.*, eri, muga, tassar and mulberry. Out of these, eri culture is the most ancient and is closely associated with tradition and culture of the people of their region. The eri silk fabric could be printed with turmeric dyes (*Curcuma longa*) by treating with different mordants to improve the colour fastness properties (Gogoi, 1998). The eri silk is always used as a plain shawl or with some woven design particularly in Ladies shawl. Therefore, the investigator felt the need and made an attempt to introduce the printed designs to enhance its aesthetic properties as well as demand in domestic and international market.

■ RESEARCH METHODS

Selection and preparation of fabric :

Plain weave eri silk fabric having following specification was taken for the experiment (Table A).

Table A : Construction particulars of test fabric

Fabric	Thread/cm		Weight	Thickness
	End	Pick	(g/m^2)	(mm)
Eri silk	18	20	195	0.592

Degumming :

Silk was treated with 2 g/l lux powder solution and 2 g/l Na_2CO_3 at material to liquor ration (M: L) was 1:20 and boiled for 60 minutes at 50°C with occasional stirring. After degumming the material was squeezed and washed thoroughly in hot water followed by cold water and then dried in air. Then the fabric was iron to removed wrinkles.

Nomenclature of the sample :

In order to identify the samples properly names were assigned against different shades were obtained by the use of different mordants, which is given in the Table B.

Table B : Nomenclature of the sample

Sample	Mordant	Shade obtained
0	-	-
UT	-	Mastered yellow
AT_1	Alum	Golden yellow
AT_2	Stannous chloride	Orange
AT_3	Ferrous sulphate	Brownish black

Selection of design for printing :

Two traditional designs were selected and name accordingly to the local terms used for the motifs and designs *viz*., Joon-Dhol Biri Phul (D_a) and Pepa-Japi Phul (D_b).

Selection of technique for printing :

Screen printing technique was selected for printing the fabric.

Selection of chemical (mordants) for printing :

The chemicals (mordant) used for the experiment were Alum (Al_2SO_4), Stannous chloride ($SnCl_2.2H_2O$), Ferrous sulphate ($Fe_2SO_4.7H_2O$), synthetic thickener (Ethyl acrylate) and fixer (Acrafix) were used for the experimental work.

Preparation of dye powder and printing paste for printing:

Preparation of dye powder :

1 kg of raw fresh turmeric (*Curcuma longa* L.) was taken and boiled in 3 liter of water for 15 minutes at a boiling temperature. After that the turmeric were dried in the sun light and powder were prepared.

Preparation of printing paste :

Printing paste was prepared by using 6 per cent of turmeric dye power, 1:2 thickener ratio, 1.5 per cent of fixer concentration, 3 per cent of mordant concentration.

Application of printing paste on fabric :

Fabric was ironed and fixed on the printing table with pins. Screen was placed on top of it and the printing paste was pouring on one side of the screen and it was spread with the help of the squeeze and dried in air for 24 hrs.

Developing of printed design :

Printed samples were wrapped in paper and then steamed at a cottage steamer for a period of 1½ hours at a boiling temperature and then dried in air (Plate 1-8).

Plate 1 : UT (Da) : Without mordanting Joon-Dhul Biri (Phul) design sample

Plate 2 : UT (Db) : Without mordanting Pepa-Japi (Phul) design sample

Plate 3 : AT1 (Da) : Mordanted Joon-Dhul Biri (Phul) design sample with alum

Plate 4 : AT1 (Db) : Mordanted Pepa-Japi (Phul) design sample with alum

Plate 5 : AT2 (Da) : Mordanted Joon-Dhul Biri (Phul) design sample with stannous chloride

Plate 6 : AT2 (Db) : Mordanted Pepa-Japi (Phul) design sample with stannous chloride

Plate 7 : AT3 (Da) : Mordanted Joon-Dhul Biri (Phul) design sample with ferrous sulphate

Plate 8 : AT3 (Db) : Mordanted Pepa-Japi (Phul) design sample with ferrous sulphate

Evaluation :

Assessment of geometrical properties :

Fabric count :

Fabric count of fabric is indicated by enumerating first the number of warp ends per inch then the number of filling picks per inch, while the fabric is held under zero tension and is free of folds and wrinkles. Determinations of count of the specimen/ samples were done with the help of pick glass.

Fabric weight :

Weight is the mass per unit area expressed in g/m^2 (ASTM, 1980). The fabric weight was determined by using electronic balance as per I.S. Method (1964-1970).

Fabric thickness :

Thickness of the distance between the upper and lower surface of the material measured under a specific pressure (ASTM, 1980). The fabric thickness was determined by using the Heals Thickness gauge under 50 gm/cm weight as per I.S. Method (7702-1975).

Visual inspection :

A group of members comprising teacher and students Assam Agricultural University, Jorhat was selected to judge and evaluate the samples using an order of rating Performa. The most important aspect of Performa includes brilliancy of colour, clarity of design and sharpness of design outline.

■ RESEARCH FINDINGS AND DISCUSSION

The findings of the study are discussed below:

Findings of geometrical properties :

Fabric count :

Count of treated and untreated eri fabric were recorded and presented in Fig. 1. Further it was noticed that sample AT_1 showed better fabric count of 10.34 per cent and 12.47 per cent in warp and weft direction followed by samples AT_2 and AT_3.

Fabric weight :

The weight of treated and untreated eri fabric/unit

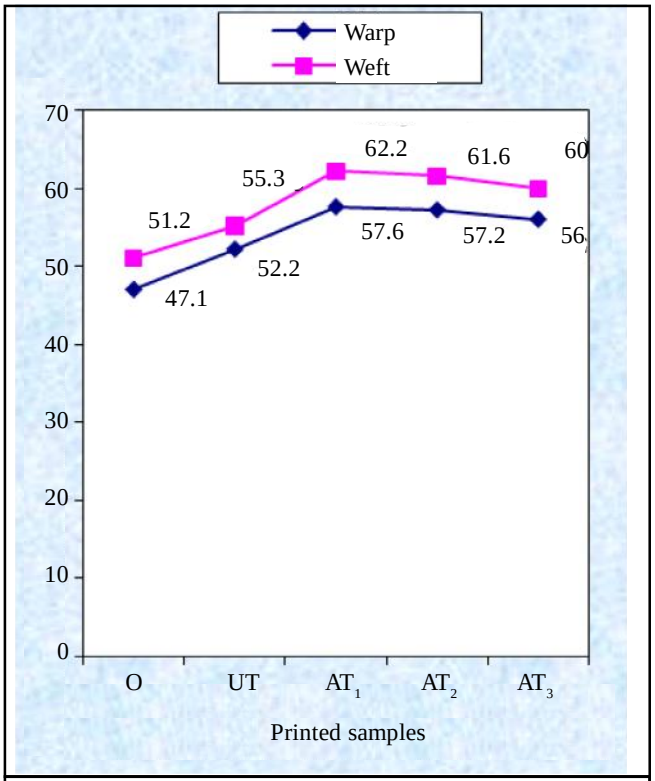

Fig. 1 : Effect of printing paste on fabric count (Thread/inch)

area was presented in Fig. 2.

Fig. 2 presented the fabric weight of the untreated and treated samples mordanted with different mordant. The weight/unit area was found to be maximum for all the printed samples. Among all the samples AT_1 mordanted with alum showed maximum fabric weight (3.29 %) followed by $AT_2$and AT_3 (3.06 and 3.06 %), respectively.

Thickness of fabric :

Thickness of treated and untreated eri fabric were recorded and presented in Fig. 3.

It was revealed from the Fig 3 that all the samples have increased in thickness. Increased thickness of treated samples were found maximum for sample AT_3 (2.55 %) followed by AT_2 (1.44 %) and AT_1 (0.64 %), respectively. In case of sample UT, thickness had increased by 2.62 per cent.

The Table 1 depicted that the high brilliancy of colour was obtained in samples mordanted with stannous chloride (AT_2) and ferrous sulphate (AT_3)for the both designs. In respect of clarity of design and sharpness of design outline were found best in samples mordanted with stannous chloride (AT_2) and ferrous sulphate (AT_3) followed by samples mordanted with alum and untreated samples, respectively.

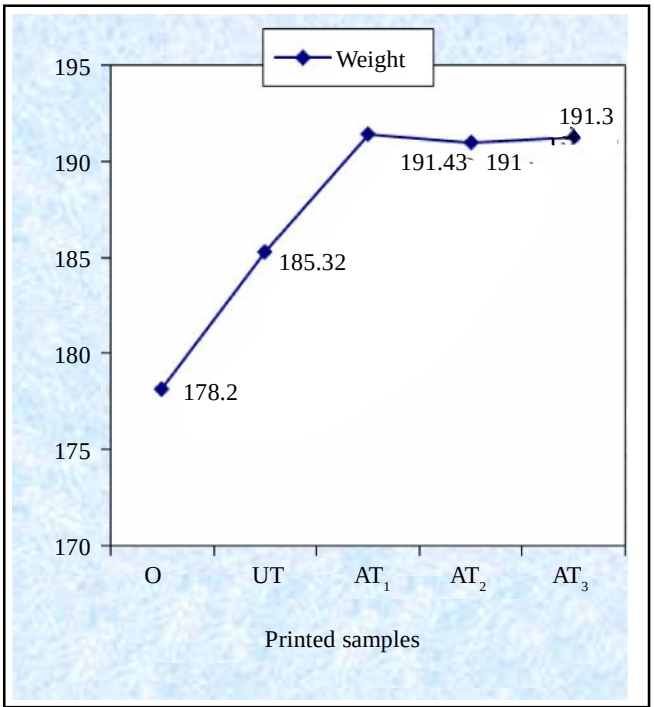

Fig. 2 : Effect of printing paste on fabric weight (g/m²)

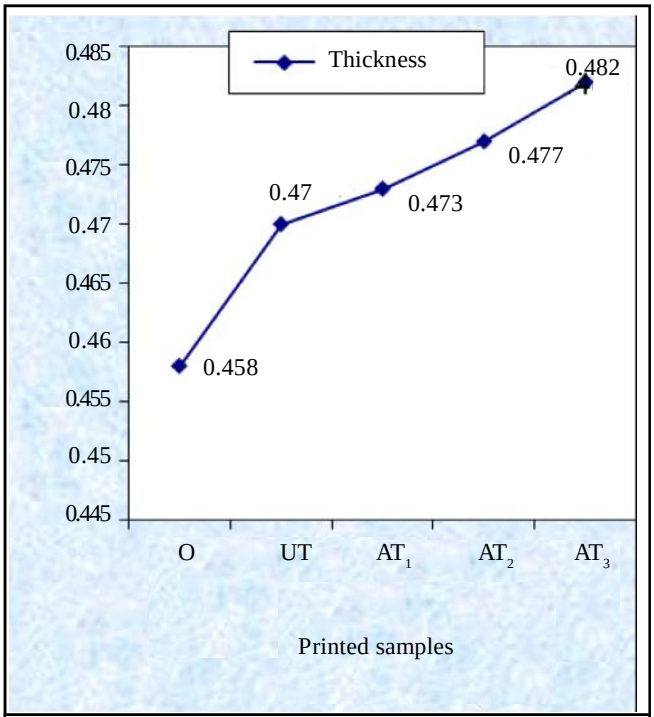

Fig. 3 : Effect of printing paste on fabric thickness (mm)

Table 1 : Evaluation of design

Samples	Design	Brilliancy of colour			Clarity of design				Sharpness of design			
		High	Moderate	Low	Very good	Good	Fair	Poor	Very good	Good	Fair	Poor
UT	D_a	88	10	2	90	8	2	-	90	6	4	-
	D_b	88	10	2	90	10	-	-	90	6	4	-
AT_1	D_a	90	8	2	96	2	2	-	94	6	-	-
	D_b	90	8	2	90	10	-	-	94	6	-	-
AT_2	D_a	98	2	-	98	2	-	-	94	6	-	-
	D_b	98	2	-	98	2	-	-	94	6	-	-
AT_3	D_a	98	2	-	98	2	-	-	96	4	-	-
	D_b	98	2	-	98	2	-	-	96	4	-	-

Conslucion :

From the experiment it could be concluded that both the traditional design is found suitable for printing the eri silk fabric with screen printing, which enriched the surface the fabric as well as add beauty to the fabric. Considering its geometrical properties, it can be inferred that the eri printed fabric can be utilized for producing the different diversified product. In respect of design evaluation brilliancy of colour, clarity of design and sharpness of design outline were also found better acceptability. Moreover, it can be also commercialized and more emphasized on exposing in the domestic and as well as international market which can play a significant role in improving of rural economy.

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