International Journal of Textile and Fashion Technology (IJTFT)
ISSN(P): 2250-2378; ISSN(E): 2319-4510
Vol. 5, Issue 4, Aug 2015, 27-32

ECO-PRINTING OF ERI SILK WITH TURMERIC NATURAL DYE

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ABSTRACT

An investigation was carried out to find out the printing effect of turmeric (*Curcuma longa)* dye paste on physical properties of eri silk fabric. Plain weave eri silk fabrics with three different mordants (alum, stannous chloride and ferrous sulphate) were selected for the study. Fabrics were printed with using screen printing techniques with two traditional designs. From the experiment it was found that all the printed samples exhibited an increasing trend increase recovery angle, abrasion resistance, stiffness of fabric. The samples mordanted with alum exhibited the better result in respect of all the physical properties compared to the other printed samples.

KEYWORDS: Eco-Friendly, Eri silk, Mordant, Physical Properties, Printing, Turmeric Dye

INTRODUCTION

The art of printing colour onto fabrics originated thousands of years ago. Printing produces more colourful effect on the fabric and was also practiced in India thousands of years before the Christian Era. Printing is application of colour in the form of a design which can be done by hand or machine. Hand printing is of two types *viz.*, block printing and screen printing. Dyes used in printing are same as in regular dyeing but instead of the thin dye bath solution thickener combination are necessary for printing. 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 is also said to be a poor person's silk as it is not as high priced as other silk type. In India, eri was mostly used with oven design for the preparation of winter shawls, jacket for men and women. Deess materials and baby dresses are also made from Eri silk fabric, because of its soft texture and moisture absorbant quality. Eri silk durable and strong and has a typical texture; hence, it is widely used in home furnishing like curtains, bed covers, cushion covers, etc. 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.

MATERIALS AND METHODS

Selection and Preparation of Fabric

Plain weave eri silk fabric having following specification was taken for the experiment.

Table 1: Construction Particulars of Test Fabric

Fabric	Thread/cm		Weight Thickness (gm/m2)	(mm)
	End	Pick		
Eri silk	18	20	195	0.592

Degumming

Eri 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. After that fabric was iron to removed wrinkles.

Nomenclature of the Sample

The samples names were assigned against different shades were obtained by the use of different mordants, which are given in the table below:

Table 2: 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 namely 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 ($Fe2SO_4.7H_2O$), 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 powder, 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.

EXPERIMENTAL FINDINGS AND DISCUSSIONS

It was evident from the Table 3 both the warp and weft direction of all the samples showed a significant increased increase recovery angle. The crease recovery angle in warp direction was greater than that of weft direction. The result of the data also indicated the untreated sample (UT) exhibited maximum increased increase recovery angle (10.83 per cent) followed by treated samples as AT_1, AT_2 and AT_3 (7.31 per cent, 4.96 per cent and 3.87 per cent) in warp direction respectively. In weft direction, the sample mordanted with alum (AT1) showed the highest crease recovery angle (12.67 per cent) and sample mordanted with ferrous sulphate (AT_3) showed the lowest crease recovery angle (8.48 per cent). The increase and decreased increase recovery may be due to different chemicals used in preparing the paste.

Table 3: Effect of Printing Paste on Fabric Crease Recovery Angle (Degree)

Direction of fabric	O	UT	AT1	AT2	AT3
WARP	120.36	133.40	143.15	140.02	138.56
% change in warp		+10.83	+7.31	+4.96	+3.87
WEFT	107.87	121.50	136.89	133.08	131.81
% change in weft		+12.63	+12.67	+9.50	+8.48

Note: '+'ve sign indicates increase in crease recovery angle

Percent change of untreated sample (UT) is calculated from O sample

Percent change of treated samples were calculated from UT sample

The Table 4 revealed that all the samples had increased in abrasion resistance. The increase abrasion resistance of untreated sample (UT) was found 10.76 per cent. However, among all the treated samples with different mordants were found to be higher abrasion resistance (4.16 per cent) in sample mordanted with alum (AT_1) than AT_2 (1.38 per cent) and AT_3, (1.38 per cent).The decrease in abrasion resistance may be due to effect of different chemicals used in preparing paste and increase may be due to absorption of paste.

Table 4: Effect of Printing Paste on Abrasion Resistance of Fabric (Cycle to Rupture)

Aspect	O	UT	AT_1	AT_2	AT_3
Abrasion resistance	65	72	75	73	73
% change in abrasion resistance		+10.76	+4.16	+1.38	+1.38

Note: '+'ve sign indicates increase in abrasion resistance

Percent change of untreated sample (UT) is calculated from O sample

Pcent change of treated samples were calculated from UT sample

Both warp and weft direction of treated and untreated samples indicated an increased in bending length reported in Table 5. The maximum increased was found in sample AT_3 mordanted with ferrous sulphate (37.83 per cent) followed by AT_2 (32.11 per cent), AT_1 (17.96 per cent) and UT (1.43 per cent) in weft direction. Whereas the sample in warp direction, as for AT_1 mordanted with alum showed increased by 34.09 per cent, AT_2 mordanted with stannous chloride by 30.30 per cent, AT_3 mordanted with ferrous sulphate by 28.21 per cent and untreated sample (UT) by 25.37 per cent respectively. Increasesed in breaking strength in both warp and weft due to higher crimp percentage and also due to the

increase in size of the dye molecule after using the chemical as a metal salt.

Table 5: Effect of Printing Paste on Bending Length (cm) of Fabric

Direction of fabric	O	UT	AT_1	AT_2	AT_3
WARP	2.64	3.31	3.54	3.44	3.385
% change in warp		+25.37	+34.09	+30.30	+28.21
WEFT	3.145	3.19	3.71	4.155	4.335
% change in weft		+1.43	+17.96	32.11	+37.83

Note: '+' ve sign indicates increase in bending length

Percent change of untreated sample (UT) is calculated from O sample

Percent change of treated samples were calculated from UT sample

From the Table 6 it was evident that all the samples found an increased trend in flexural rigidity in warp and weft direction. Highest increased was observed in sample mordanted with ferrous sulphate (AT_3) by174.12 per cent followed by AT_2 (137.78 per cent), AT_1 (70.11 per cent) and UT (8.133 per cent) in weft direction. The sample mordanted with alum (AT_1) showed maximum increased in flexual rigidity in warp direction by 149.87 per cent and the untreated sample (UT) showed lowest flexural rigidity by 104.27 per cent, respectively. The decreased in flexural rigidity may be use of chemicals in preparing the printing paste and increase may be due to absorption of dye paste.

Table 6: Effect of Printed Samples on Flexural Rigidity (mNmm) of Fabric

	O	UT	AT_1	AT_2	AT_3
WARP	34.83	71.15	87.03	79.46	76.85
% change in warp		+104.27	+149.87	+128.13	+120.04
WEFT	58.89	63.68	100.18	140.03	161.43
% change in weft		+8.183	+70.11	+137.78	+174.12

Note: '+' ve sign indicates increase in flexural rigidity

Percent change of untreated sample (UT) is calculated from O sample

Percent change of treated samples were calculated from UT sample

CONCLUSIONS

The present experiment unveiled that the printing paste of turmeric can be successfully utilized to print the eri silk fabric which is eco-friendly, non-carcinogenic and biodegradable. The printing of eri silk fabric with turmeric dye produced various soft and stable natural print. Sample mordent with alum showed the better result in respect of all the physical properties compared to the other printed sample.

On the other hand turmeric has various medicinal properties. It is used to cure pain, boils, pimples, piles etc. So eri fabrics printing with turmeric dye paste may relive body pains. Thus printing eri silk fabric with turmeric dye paste give a new look to this poor man's friend, will boost in preparing diversified products. Such efforts are required to improve the quality and aesthetic value of eri silk to match with new trends in national and international market.

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APPENDICES

	
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**