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Optimization of Traditional *Bagh* Printing Method using Contemporary Materials and Techniques

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ABSTRACT

Bagh print is a unique and traditional printing produced in *Bagh*, Dhar district of Madhya Pradesh, India. *Bagh* print designs are typically geometrical, paisley, or floral compositions dyed with vegetable colours of red and black over a white background and are a popular traditional textile product. But the process is very tedious and time consuming for the craftsmen to compete in the present globalized world where fast fashion is a key to commercial success. The present study aims to recreate this natural printing method by using contemporary materials and techniques that are easy to procure and implement by the craftsmen. So, the process was redefined by optimizing the contemporary materials which are easily available, low cost and environment friendly so as to save time, labour and money besides retaining the traditional essence of printing method at the same time. The printing was carried out with optimized printing paste developed with contemporary materials on cotton fabric using wooden blocks having traditional motifs specific to the traditional *Bagh* printing. The rich red and black colours were obtained on white background after dyeing with alizarin dye and subsequent post treatments. The colour fastness of the printed fabric was assessed to light, washing, rubbing and perspiration and good to excellent fastness results were observed. The modified *Bagh* printing method thus can be easily adopted by the craftsmen to keep this craft alive and sustainable.

Keywords: *Bagh p*rinting, Contemporary, Colour fastness, Optimization, Traditional textile

INTRODUCTION

Printing is the technique of adding colour to cloth in specific patterns or designs. It is the most flexible form of fabric decoration. It is a form of visual expression that resembles drawing and painting that is made by using simple tools and materials. India was the ancient world's colour box, as well as the birthplace of the earliest printed textiles. The block printing process is based on hand-carved wooden blocks. The process of carving a block is time-consuming and requires an experienced labour. This labour has been trained through generations to generations. Blocks have a wooden holder and two or three columnar bored into the block to allow release wind flow and the enable to escape excess stamping blend. The newly engraved blocks are dipped in oil for 10-15 days to soften the grains (Preetha, 2024). *Bagh* is a small town in *Kukshi,* Madhya Pradesh, nestled in the Narmada Valley on the southern Vindhya hills, with rock-cut caves and *Bagh*-printed textiles known for their black and red outline motifs were first worn by tribal communities from nearby villages. The region name is derived from tigers (*Bagh*) that once roamed the area (Karolia, 2019). *Bagh* print is a unique and traditional printing produced in *Bagh*, Dhar district of Madhya Pradesh, India. *Bagh* print designs are naturally geometrical, paisley, or floral compositions dyed with vegetable colours of red and black over a white background and are a well known textile printing product. Its nomenclature comes from the village *Bagh*, which is whereabouts on the banks of the *Bagh* River (Khan, 2018). *Bagh* printing origins are thought to date back, between 1500 and 1600 years and are somewhat

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ambiguous due to a lack of precise historical documentation. However, insights from artisans, expert commentary and secondary sources points out at its enduring legacy. Each block in *Bagh* printing tells a unique story that is deeply embedded in nature. Prints with pomegranates and mangoes (*keri*) represent the changing seasons, whereas those with lemons (*nimboo*) and millet (*Juaaria*) serve as poignant reminders of humanity's intrinsic connection to the natural world. *Bagh* prints not only adorn fabrics with these motifs, but they also tell stories about cultural heritage and environmental harmony (Hashmi *et al.,* 2018).

METHODOLOGY

Fabric:

Pure cotton fabric in plain weave was procured from the local market. It was then scoured by immersing in a solution of 5 grams of non-ionic detergent and 10 grams of carbonate per litre of water, which was subsequently boiled for an hour to speed up the process, rinsed completely, and sun dried (Babel and Gupta, 2015).

Pre-treatment of fabric:

The fabric was treated with myrobalan solution using 2g of myrobalan/gm of fabric for 12 hours keeping MLR 1:20 (Babel and Gupta, 2015). The myrobalan treated fabric was then squeezed and dried in sun. The pale yellow toned fabric was then ready to be printed.

Optimization of the red printing paste:

Concentration of Alum:

The alum mordant was taken at four different concentrations - 5 gm, 10gm, 15 gm and 20 gm whereas the amount of gum was constant *i.e.* 2gm. The paste was prepared by mixing the two ingredients in mixer to get an even consistency. It was then applied on four different myrobalan treated fabrics. The fabric was dried in hot air oven at 60° C for 8 hrs so that the paste can be absorbed by the fabric properly. These fabrics were washed thoroughly in running water, till excess paste was removed. The fabric was dyed with alizarin dye to get red colour print. The printed sample having brighter shade and maximum light fastness was considered to be optimum alum concentration and selected for next process.

Concentration of Guar gum:

For optimizing the concentration of guar gum in the paste, four different concentrations were taken *i.e.* 0.5gm, 1 gm, 1.5 gm and 2gm and the optimized concentration of alum was added in each paste. The printed sample having brighter shade and maximum light fastness was considered to be optimum and selected for next process.

Optimizing the black printing paste:

Concentration of ferrous sulphate:

For optimizing the amount of ferrous sulphate, four concentrations - 10 gm, 12gm, 14gm and 16 gm were taken in 100ml water. The amount of tannic acid (2 gm) and guar gum (2 gm) were kept constant. The four pastes with different amount of ferrous sulphate were then applied to four fabric samples. These samples were fabric then dried in hot air oven at 60° C for 12 hrs so that the fabric absorbs the mordant properly. The fabrics were then washed thoroughly and separately to avoid bleeding. The samples were then tested for light fastness. The concentration at which the sample gave maximum fastness to light was selected as optimum.

Concentration of tannic acid:

For optimizing the concentration of tannic acid, four concentrations were selected *i.e.* 1gm, 1.5 gm, 2 gm, and 2.5 gm. The optimized concentration of ferrous sulphate was added in each concentration. Guar gum (2 gm) was kept constant and 5 gm of sodium carbonate was added. The concentration at which the sample gave maximum fastness to light was selected as optimum.

Concentration of guar gum:

The guar gum was added in four different concentrations - 1gm, 1.5gm, 2gm and 2.5 gm to the four pastes prepared with the optimum amounts of ferrous sulphate and tannic acid. The consistency of the paste was different for all the four pastes. The concentration that gave best imprint on the fabric after applying the paste with a wooden block was considered optimum.

Concentration of sodium carbonate:

The sodium carbonate was added in four different concentrations- 2 gm, 3 gm, 4 gm and 5 gm to the four different pastes prepared with the optimized ferrous sulphate, tannic acid and guar gum. Sodium carbonate was added to maintain the alkalinity of the paste which was required for better absorption of the mordant. The concentration at which the samples gave the minimum bleeding after washing was selected as optimum.

Printing:

The printing paste was applied on four myrobalan treated fabrics separately with wooden block and the fabric was dried in hot air oven at 60° C for 8 hrs so that the fabric absorbs the mordant properly.

Dyeing:

The dyeing was done using alizarin dye taking material to liquor ratio 1:40 and dye as 1.5 per cent of the weight of the fabric, temperature 80° C and dyeing time 30-45 min till the dye liquor was exhausted (Chemchame *et al.,* 2016). The white colour background was obtained by bleaching the printed fabric at optimized conditions.

Colour Fastness properties:

The printed samples were tested to fastness to light, washing, rubbing and perspiration. They are as follows:

- ***Light fastness test***: The colour fastness of dyed fabric samples to light was evaluated using the BIS Standard Test Method IS: 2454-1985. Samples were exposed to MBTL fading lamp light for a minimum of 5 hours. They were placed near the lamp until they faded to match a specific grade on the blue wool scale.
- ***Washing fastness test***: To evaluate the washing fastness of the dyed samples, the Standard Test Method prescribed by BIS (IS: 3361-1979) was used. The original and test specimen was compared and gave the fastness rating with the help of grey scale for evaluating colour change.
- ***Rubbing fastness test***: The colour fastness of the dyed samples to rubbing was assessed using the test prescribed by BIS *i.e.* IS: 766-1988 in both dry and wet condition. The different grades in the gray scale for change in colour and staining were compared with the test samples to give fastness grades in accordance with standard grey scales.
- ***Perspiration fastness test***: The Standard Test Method which was prescribed by BIS IS: 971-1983 was used for determining the colour fastness to perspiration of dyed samples. The test samples were evaluated against grey scales for colour changes and staining.

RESULTS AND DISCUSSION

The final printing on the cotton fabric was done using the optimized printing recipe as depicted in Table 1. The red printing paste was prepared by blending 25 gm of alum and 2 gm of guar gum in 100 ml of water. In this paste, 0.5 gm of red ochre powder was added to give a tint of colour while printing on the fabric. And the black printing paste was prepared by mixing 12 gm of ferrous sulphate, 2.5 gm of tannic acid and 2.5 gm of guar gum which was added to 100 ml of water. Dyeing was done using 1.5 gm alizarin dye for each gram of fabric, M:L:R 1:40, dyeing temperature for 80° C and dyeing time for 45 min (Chemchame *et al.,* 2016) to give the best colour on the fabric. The background of *Bagh* printed fabric was bleached by using 10 ml of sodium hypochlorite, 10 minutes the process of bleaching continued at 50° C.

Table 1: Optimized recipe of *Bagh* printing method

Ingredients for red paste	**Concentration (gm)**
Alum	25
Guar gum	2
Red ochre powder	0.5
Water	100ml
Ingredients for black paste	**Concentration (gm)**
Ferrous sulphate	12
Tannic acid	2.5
Guar gum	2.5
Water	100ml
Dyeing process	
Alizarin	1.5 gm/gm of fabric
M:L:R	1:40
Dyeing Temperature	80° C
Dyeing Time	45 min
Bleaching process	
Sodium hypochlorite	10 ml/lt
Bleaching Temperature	50° C
Bleaching Time	10 min

Table 2 represents the different ingredients that are used in traditional printing method and the modified printing method. Some of the ingredients that are used in traditional method are not easily available in one region so contemporary ingredients which are easily available everywhere were used to make the process easy and sustainable.

Table 3 shows the changes of time duration between the traditional printing recipe and modified printing recipe. The used of contemporary ingredients can speed up the printing process and can save time. In scouring process, time taken in traditional printing recipe was 1 day but in modified printing recipe it can be done in 45 minutes. Likewise in all the other process, reduction of time can

Table 2 : Replacement of traditional ingredients with modified ingredients for *Bagh* printing method

Process	Traditional ingredients	Modified ingredients
Scouring	Animal dung, castor oil and alkali	Non-ionic detergent and sodium hydroxide
Myrobalan treatment	10-15 minutes of treatment	12 hours of treatment
Black colour	Rusted iron, jaggery and tamarind seed powder	Tannic acid, Ferrous sulphate and guar gum
Red colour	Alum and tamarind seed powder	Alum, guar gum and red ochre powder
Scouring	Animal dung, castor oil and alkali	Non-ionic detergent and sodium hydroxide

Table 3 : Replacement of time duration in traditional recipes for *Bagh* printing method

Process	Traditional method	Modified method
Scouring	1 day	45 minutes
Myrobalan treatment	12hours	8 hours
Black colour	3-5 week	1 hour
Red colour	Over night	1 hour
Drying after printing	1 day	6 hours
Dyeing	3-4 hours	60 minutes

be seen.

Colour fastness of cotton fabric printed with modified *Bagh* printing method:

The colourfastness of the *Bagh* printed fabric to light, washing, rubbing and perspiration is depicted in Table 4.

It is evident from the results furnished in the Table 4 that the light fastness of red and black printed samples was found to be good (grade 5). The washing fastness in terms of colour change for red print was excellent (grade 5) but for black print, it was good (grade 4). In case of colour staining, no staining or negligible staining was observed in both the composite specimens for both the printed samples. Rubbing fastness grades for colour change in wet conditions for red printed sample was observed to be excellent (grade 5) and for black print it was good (grade 4). For colour staining in wet condition, red print showed no staining (grade 5) but the black print showed noticeable staining (grade 3). In case of rubbing in dry conditions no staining was seen (grade 5) for red colour whereas black print showed very slight staining (grade 4/5).

The perspiration fastness grades in term of colour change in acidic medium for red printed samples showed excellent fastness (grade 5). A negligible or no staining (grade 5) was observed for red print on both the cotton and wool adjacent fabrics. But in case of black print, grade 4 (good fastness) was obtained in colour change due to acidic perspiration and very slight staining (grade 4/5) on cotton fabric and slight staining (grade 4) on wool fabric was seen. As far as perspiration fastness in alkaline medium is concerned, both the printed samples obtained grade 4/5 (very good) in term of colour change. For colour staining, red print showed no staining (grade 5) on both the composite specimens and for black print, grade 4/5 (very slight staining) was seen on cotton fabric and slight staining (grade 4) on wool fabric.

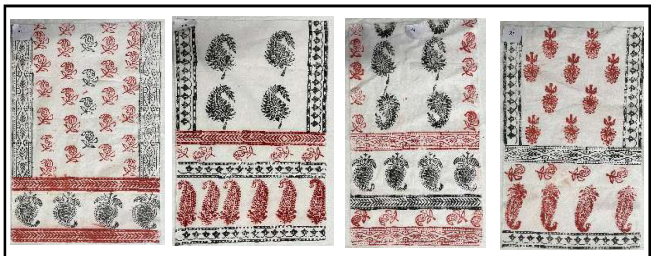

Fig. 1 : Samples printed with modified *Bagh* printing method

Conclusion:

The *Bagh* printing method was optimized by combining modern materials and techniques, which considerably reduced time and labour. The samples

Table 4 : Colour fastness grades of cotton fabric printed with modified *Bagh* printing process

Sample	Light fastness	Washing fastness			Rubbing fastness				Perspiration					
		CC	CS		Wet		Dry		Acidic			Alkaline		
			C	W	CC	CS	CC	CS	CC	CS		CC	CS	
										C	W		C	W
Red print	5	5	5	5	5	5	5	5	5	5	5	4/5	5	5
Black print	5	4	5	5	4	3	4	4/5	4	4/5	4	4/5	4/5	4

printed with optimized printing paste and dye with alizarin dye showed excellent results in terms of light, washing, rubbing, and perspiration fastnesses. It can also improve production efficiency to fulfil the growing demand for sustainable and environmentally friendly products. It can be concluded that the conventional *Bagh* printing method can be successfully adapted by replacing some of the ingredients with others that are faster and easier to obtain, while yet retaining the traditional effect of this printing method.

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