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RESEARCH PAPER
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Assessing the Effect of Natural Mordant for Printing on Cotton

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ABSTRACT

Printing has been a media for value addition and beauty on body skin, fabrics, interiors and exteriors of buildings. The use of the available colour pigments from leaves, fruits, berries and minerals call back to ancient times. Though natural dyeing is widely carried out today, little study is available on printing with natural dye. This initiates the need for application of natural resources for textile printing which will reduce effluent. There are endless natural resources which can be exploited for imparting natural colour pigments to increase the functional and aesthetic properties to textile. Development of shades and fixation of natural dyes on natural fibres like cotton depends on the use of mordants. Mordants provide specific colours as well as improved wash and light fastness. This study aims at assessing effect of mordant for marigold flower as dye source, printing using the extracted pigments and evaluating the physical properties of printed fabrics.

Key Words : Printing, Natural mordant, Marigold, Gum arabic

INTRODUCTION

There is a growing interest towards eco products among people due to awareness on the environmental problems. Synthetic dyes and chemicals are non-biodegradable and carcinogenic and pose a major threat to health and the environment. However dyeing and printing is an important process in textile finishing. Natural dyes are revived and are widely used for textile colouring now-a-days.

But they need mordants to fix them on to the textile substrate. Those mordants used along with natural dyes are metallic salts. Metallic mordants used during natural dyeing are not eco-friendly. Also most of the metals are discharged as effluent. This also will create pollution problems. The metal salts present in the finished goods also affect the wearer. Although studies have been carried out to improve the fastness properties of natural dyes the little attention has been given to the other functions of mordants/natural dyes combination (Samanta and Konar, 2011).

Use of natural mordants in printing paste may make natural printing more eco friendly. There is an increasing demand for eco-textiles which necessitate the use of natural dyes and natural mordants. Hence this study was carried out to get prints with marigold flower as dye source using natural mordants and eco friendly thickeners.

METHODOLOGY

Material used :

Cotton has superior weaving qualities, high tensile strength, good absorption, low cost, above all abundant usage. Also it is an ideal fabric for all seasons. Hence cotton fabric was used for the study.

Number of warps per inch : 102

Number of wefts per inch : 78

Cotton fabric was desized by boiling in detergent solution for five minutes, and rinsed in water thoroughly.

Selection of natural dyes :

Dyes obtained from nature are eco friendly and have

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good demand today. Marigold (*Tagetes erecta Linn*.) petals as natural dyes can be used for printing of fabrics (Agarwal *et al*., 2007). Dye extracted from Marigold flower can be used for coloration of cotton fabric (Jyothi, 2008). Marigold flowers are also commonly available, hence was used for the study. Marigold flowers were collected from local market, dried in shade for a week and powdered, sieved and stored in an air tight container.

Dye source | Dye powder | Screen printing

Fig. 1 : Dye source

Selection of mordants :

Development of shades and fixation of natural dyes on natural fibres like cotton depends on the use of mordants. Mordants provide specific colours as well as improved wash and light fastness. Different mordant concentration showed difference in shade on the fabric. (Vankar *et al.*, 2007). Metallic mordants are usually used to produce bright and fast colours, but are not always eco friendly. By mixing different natural dyes in various proportion newer shades can be produced on fabrics. (Samanta and Agarwal, 2009), Different mordants may create different effect in fading of yellow natural dyes. The type of mordant used , the concentration and the dye used along has a strong influence on wash and light fastness properties (Samantha and Konar, 2011).

Tannin is the most widely used mordant. They produce indispensable mordants for the dyeing of vegetable fibres like cotton and linen (Prabhu *et al.*, 2012) Myrabolan is an most important source of tannin (Khan *et al.,* 2005). Cotton has a low affinity for most natural dyes. When basic dyes are applied to tannic acid mordanted cotton; electrovalent bond is formed between the dye and acidic groups in the tannic acid. Pomegranate rind can be used as a mordant and as a substitute for Harda. In some cases the rind can be used to produce new shades . Considering this and the easy availability, natural mordants namely, myrobalon and pomegranate rinds were used for the study.

Selection of thickeners :

Gum arabic is a natural gum used for textile printing (Gahlot, 2003). It has high solid content, contains dried plant extrudes and is available in the market. The thickener is prepared by mixing required amount of gum with cold water and allowed to stand for eight hours during which it was stirred at regular intervals. The floating bits and lumps were filterd and the solution is boiled for an hour by constant stirring. Then it was strained and collected to prepare the printing paste.

Selection of printing method :

Cotton fabric are generally printed by manual printing methods, using either block or screen. (Boruah and Kalita, 2016). Screen printing is the most popularly employed method. It is capable of yielding highly artistic results, some of which are unobtainable by any other method. So screen printing method was selected for the study.

Printing :

Printing was carried out on cotton fabric using the dye source marigold, Three different pastes were prepared by varying the mordant. Paste 1 was prepared by mixing dye source with the thickener. Paste 2 and paste 3 were prepared with dye source, thickener solution along with the mordants pomegranate rinds and myrobalon respectively. The proportion of the materials used are given the following Table 1.

Table 1 : Different ratio of the printing pastes

Paste 1	Paste 2	Paste 3
Marigold flower Powder: 15 parts	Marigold flower Powder: 10 parts	Marigold flower Powder : 10 parts
Gum : 4 parts	Pomegranate	Myrobalon: 5 parts
Water : 1 liter	rinds: 5 parts	Gum : 4 parts
	Gum:4 parts	Water : 1 liter
	Water:1 liter	

Fabric was ironed and fixed on the table. Screen was placed on top of it and the printing paste was poured into the well of the screen frame on one side of the screen. It was spread with the help of the squeeze and transferred through on to the cloth underneath by drawing using a squeeze. Two to four strokes were given to every design for the printing to complete. Three different samples were prepared using the three types of printing paste 1, 2 and 3.

After treatment :

The printed samples were then dried , fixed by applying heat and then washed in water . The samples

were then pressed and evaluated

Nomenclature of the Samples :

O- original cotton sample, D- fabric printed with marigold flower dye source, DP- Fabric printed with paste of dye source and Pomegranate rinds, DM- Fabric printed with paste of dye source and Myrobalon,

RESULTS AND DISCUSSION

Printed samples were evaluated for fabric tear strength and colour fastness to washing, sunlight, crocking and pressing.

Tear strength :

Tear resistance is one of the important properties of a fabric. The tear strength refers to its resistance to tearing force .

Tear strength tester was used to measure the tear strength. Samples were cut using the template, along the warp and weft directions randomly. The samples were mounted between the clamps and tester was swung. The readings were noted and the mean value calculated for the warp and weft directions separately. Tear strength of samples in the warp and weft directions are presented in Table 2 and 3, respectively.

The weight of the printed samples decreased when compared to the original sample along the warp direction. Samples DP, DM had a loss by twenty six percent Sample D had minimum strength loss of nine percent. The decrease in the strength could be due to the use of mordants.

The tear strength of printed samples along the weft direction decreased in comparision to original sample. Samples DP, DM had maximum loss of twenty nine percent while sample D had a minimum loss of seventeen percent.

Colour fastness :

Colour fastness of a textile material is its resistance to change colour by light, washing and rubbing . It is the resistance to change in any of its colour characteristics, to transfer of its colourants to adjacent materials or both as a result of the exposure of the material to any environment that might be encountered during the processing, testing, storage or use of the material. When a colour material is subjected to particular conditions e.g. light, washing, milling and bleaching, the colour may change in depth, hue or brightness. The resistance of a coloured material to any such change in colour is termed as its colourfastness. A fabric that retains its colour during

Table 2 : Tear Strength of the printed samples (Warp)

Sr. No.	Samples	Mean Strength (Kgms)	Loss or gain over original (Kgms)	Percentage Loss or gain over original
1.	Original	46	-	-
2.	D	42	4	9
3.	DP	34	12	26
4.	DM	34	12	26

Table 3 : Tear Strength of the printed samples (Weft)

Sr. No.	Samples	Mean Strength (kgms)	Loss or gain over original (kgms)	Percentage Loss or gain
1.	Original	45	-	-
2.	D	37	8	17
3.	DP	32	13	29
4.	DM	32	13	29

Table 4 : Colour Fastness of the printed samples

Sr. No.	Samples	Sunlight colour change	Washing		Pressing				Crocking			
			Colour change	Staining	Wet		Dry		Wet		Dry	
					Colour change	Staining	Colour change	Staining	Colour change	Staining	Colour change	Staining
1.	D	¾	3	¾	4	¾	5	4/5	4	4	4/5	4
2.	DP	3	3	¾	4	¾	5	4/5	4	4	4/5	4
3.	DM	¾	¾	¾	4/5	3	5	4/5	4	4	4	4/5

Note : 1 - very poor, ½ - 2 – poor, ¾ - Fair, 2/3 - 3 – Moderate, 4 – Good, 4/5 Very good, 5 - Excellent

use and care is said to be colourfast.

Colour fastness to sunlight, washing, wet and dry crocking, wet and dry pressing were evaluated for the samples and results are shown in Table 4

In the colour fastness test against sun light, printed samples D and DM had fair fastness and DP had moderate fastness.

With regard to wash fastness of cotton samples, almost all samples had fair to moderate fastness both in colour change and staining tests. With reference to colour fastness to wet pressing sample DM had very good fastness while samples D and DP were good. The staining test proved to have fair to moderate fastness. In dry pressing almost all sample had excellent to very good fastness in colour change. The staining test showed very good fastness of all samples.

Crocking tests reveals that samples had good fastness to wet crocking . Staining test showed that all samples had good fastness. As regards dry crocking, sample D and DP had very good fastness and DM was good to colour change. Sample DM had very good and DP sample was good to staining tests.

Conclusion :

Natural dyes is becoming more popular due to environmental awareness and the interesting shades that can be created by it. As a result, many plant resources are now being reinvestigated as alternative raw material for natural dyes. Printing is immensely used on all textiles. It is considered as part of the finishing industry and has been described as localized dyeing (Rastogi and Chopra, 2017). Improving traditional mordanting processes and selecting new mordants to replace traditional heavymetal ions has been an important part in the development of natural printing of textiles. The findings suggest that natural resources could be used for textile coloration to avoid the effluent problem. Different shades can be obtained from a single dye, using different mordants. This method of printing with natural dye will reduce the effluent discharged. This process can also be adapted at rural level as income generating activity.

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