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A comparative study on colourfastness properties of Manjistha/Moduka flower dyes

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Abstract

The general interest of researchers in the application of Natural dyes is found to be increasing for obvious reasons. These dyes cannot be considered to be competing neither in volumes nor necessarily in properties as substitutes for synthetic dyes. The main purpose of this research was to compare and study the Masulipatnam block printing done with natural dyes such as Manjistha/Moduka flower using fixation with Banana stem juice and catechu dye using fixation with alum on Cotton/Forest wood union fabric. The test to evaluate the colour fastness properties were done by subjecting the samples to Wet Pressing, Dry Crocking, Acid Perspiration. On the basis of colour fastness test it was found that Manjistha/Moduka flower fabrics showed best results compared to Catechu dyed fabrics.

Keywords: Masulipatnam block printing, fixation, crocking, perspiration, Manjistha/ Moduka flower

Introduction

A textile or cloth is a flexible material consisting of a network of natural or artificial fibres (yarn or thread). Yarn is produced by spinning raw fibres of wool, flax, cotton, hemp, or other material to produce long strands.

Clothing (also called clothes and attire) is fiber and textile material worn on the body. The amount and type of clothing worn depends on body type, social, and geographic considerations. Archaeologists have found evidence of textile dyeing dating back to the Neolithic period. In China, dyeing with plants, barks and insects has been traced back more than 5,000 years. Many natural dyes require the use of chemicals called mordants to bind the dye to the textile fibres; tannin from salt, oak galls, natural alum, vinegar, and ammonia from stale urine were used by early dyers. *Moringa oleifera* is the most widely cultivated species of the genus *Moringa*, which is the only genus in the family Moringaceae. It is a fast-growing, drought-resistant tree, native to the southern foothills of the Himalayas in northwestern India, and widely cultivated in tropical and subtropical areas where its young seed pods and leaves are used as vegetables. *Rubia cordifolia*, often known as common madder or Indian madder, is a species of flowering plant in the coffee family, Rubiaceae. Catechu is an extract of acacia trees used variously as a food additive, astringent, tannin, and dye. Masulipatnam designs are Iranian in character with intricate and delicate forms. The old traditional block prints were largely used with Persian motifs like trees, creepers, flowers and leaf designs. Block printing is a form of dyeing and coloring a fabric using wooden blocks. India is one of the largest manufacturers and exporters of block printed fabric in the world. Cotton is the world's most popular natural fiber. The fruit of the plant, better known as the cotton boll, provides the fiber the fiber of a thousand faces and almost as many uses, the fibers which the ancients called the "Kings of fibers" because of its wide array of uses and popularity around the world.

Wood fibre is well on the way towards becoming an important element of textile production around the world. The technique of manufacturing textiles from wood fibre is not new, but recent developments have resulted in something of a resurgence. Colourfastness is defined by the American Association of Textile Chemists and Colorists as "the resistance of a material to change in any of its color characteristics, to transfer its colorants 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".

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Research Objectives

- To select the Cotton/forest wood fabric suitable for block printing.
- To select the Manjistha/Moduka flower and Catechu suitable for dyeing.
- To optimize the conditions for extraction of the dye from the selected Manjistha/Moduka flower and Catechu dye for block printing.
- To dye the Cotton/Forest wood union fabric with selected natural dye extracts using natural mordant.
- To compare and evaluate the colourfastness properties of Manjistha/ Moduka flower dyes on Cotton/Forest wood union fabric and subjecting them to colorfastness tests with respect to Wet Pressing, Dry Crocking, Acid Perspiration.

Methodology

The dyed test samples were assessed for Wet Pressing, Dry Crocking, Acid Perspiration.

Selection of the fabric and dyes

Cotton/forest wood union fabric were selected for the study. Three different natural dyes were selected for the study namely, Red dye from Manjistha root, golden dye from Moduka flower and brown dye from Catechu.

Masulipatnam block printing process

The technique of applying colour onto the fabric design was done by blocks. Masulipatnam block printing process is a long process. It is a step by step process and takes many days to complete it because after each process of applying colour on to the fabric, the fabric needs to dry overnight, washed the next day and again dried. Each process takes one day.

Scouring Process

The required quantity of water was taken in a bowl. Soapnut powder was added and the temperature was raised to 70°C. The fabric was kept in soapnut solution and boiled for 2 hours. Then it was rinsed thoroughly.

Mordant Process

Myrobalan Treatment

30 grams of myrobalan seeds were taken. The outer skin was crushed and then added with water and soaked overnight. The solution was filtered the next day. The fabric was soaked for 1 hour. It was then removed, squeezed and finally dried on wooden or plastic rods.

Procedure for Block Printing With Gum Arabic Paste

Two meters of the fabric was block printed with alum. 25% of alum was mixed with gum Arabic paste (1:1). On the printing table the cotton/forest wood union fabric to be printed were stretched and printed. A small tray was kept on the trolley and the two layers of jute and one layer of muslin were laid on it. The jute layer was lifted and some amount of gum Arabic paste was poured on to it. This paste was allowed to seep through the muslin cloth and it was spread evenly using a small flat wooden spatula. This main block was pressed onto the printing paste on the tray twice in a uniform motion. The cloth was printed evenly without unnecessary gaps. The printed material was then dried in sunlight for one day.

Preparation of black dye (kassim)

The required quantity of black dye known as "Kassim" was prepared in a mud pot by soaking iron strips of ½ kg in a

solution of 25 gms of jaggery with 100gms of palm jiggery in 2 litres of water. The solution takes 21 days to mature and yield the dye. The black dye (Kassim) is used to outline and is drawn with a specially prepared block. This procedure was followed individually for the cotton/forest wood union fabrics.

Preparation of Alum Paste (Karam)

100grams of alum for 1 litre of water is used to prepare alum paste. Alum is crushed in a powder form. The water should be allowed to heat and alum powder is mixed with boiling water and diluted. Then add ½ kg of gum Arabic paste to the solution. Finally the karam paste is prepared.

Preparation of Gabbu Dye

Kassim : 20%

Karam : 80%

Mixing of black dye (kassim) and alum paste (Karam) = Gabbu.

Development of the Printed Fabric

Developing With Manjistha/ Moduka Flower

The required quantity of red dye and yellow dye was prepared by boiling 3 litres of the water to which 20 grams of manjistha root and 80 grams of moduka flower. The dye was boiled well and dye solution was extracted and boiled again. Then, the fabric to which alum was already applied onto the design areas while mordanting was added into the boiling dye bath. Red and golden yellow dye absorbed in such designs areas of the fabric created with alum whereas the other area of the fabric got pink colour. The fabric was then removed from the dye bath and then washed in cold water and allowed to dry.

Fixation with Banana Stem for Manjistha/ Moduka Flower Dyes.

The banana stem should be cut into small pieces and grind using water to prepare a solution. The fabric which is dyed using manjistha/moduka flower is allowed to remain in banana extract solution for 1/2hr. The fabric was then removed from the solution and washed in cold water and allowed to dry.

Developing With Catechu

The required quantity of brown dye was prepared by boiling 1 litre of water to which 30 grams of catechu (kasikatti). The dye was boiled well and the solution was extracted and boiled again. Then, the fabric to which alum was already applied onto the design areas while mordanting was added into the boiling dye bath. Brown dye is absorbed in such designs areas of the fabric created with alum whereas the other area of the fabric got pink colour. The fabric was then removed from the dye bath and then washed in cold water and allowed to dry.

Fixation with Alum for Catechu Dye

Alum is crushed in a powder form. The water should be allowed to boil and alum powder is poured into the solution. The fabric which is dyed using catechu is allowed to remain in the alum solution for 1/2hr. The fabric was then removed from the solution and washed in cold water and allowed to dry.

Colour Fastness of Tests

Colour fastness tests were carried out on the sample to find out whether the masulipatnam block printed samples showed good fastness properties. The printed test specimen was taken

from cotton/forest wood fabrics. The following tests were done on the printed test samples namely, colourfastness to pressing (dry and wet), crocking (dry and wet) and perspiration (acid alkaline). An original masulipatnam block printed test sample was kept aside as the control sample for the purpose of evaluation in each case.

Preparation of Test Specimens

The masulipatnam block printing samples required for colourfastness tests were prepared individually and used for colour fastness test. Sample measuring 5”x5” were cut from cotton/forest wood fabrics for each colour fastness test. The colour fastness properties of the samples in terms of colour change and colour transference was done using British Standard Grey Scale.

Colourfastness of Pressing

Wet Pressing

This test determines whether the test samples will show colour change or colour transferences on both when subjected to wet pressing. The masulipatnam block printed test specimen was soaked in distilled water and squeezed to retain 100% moisture. Then the same procedure as above was followed. To evaluation for colour change and colour transference of the cotton/forest wood was done using the grey rating.

Colour Fastness of Crocking

This test determines the colour fastness of the masulipatnam block printed samples to rubbing and abrasion.

Dry Crocking

The crocking test was done with the help of a device called CROCKMETER. The test specimen of masulipatnam block printed cotton and forest wood fabrics each measuring 6 inch, 3 inch was used for this test. The sample was fixed firmly to the rubbing surface using the clamp screws and dry to inch square piece of white fabric was fixed to the finger of the rubbing device. The specimens were subjected to crocking by moving the white test piece on the wooden block to and for 10 cycles in 20 seconds. Care was taken to apply pressure evenly and to slide the block at uniform speed.

Colour Fastness to Perspiration

This test was conducted to find out the fastness of the samples of cotton/forest wood acid and alkaline perspiration.

Acid Perspiration

The three ingredients mentioned above were added to 1000cc (1litre) of distilled water to form a solution. The test sample was thoroughly wetted in the acid solution, rolled with the undyed white cloth on the outside and inserted into the glass tube, leaving one third of the projecting outside. The tubes were placed in the drying oven at a temperature of 37c+2c for 6 hours and then dried in air. The procedure was followed individually for the cotton/ forest wood fabrics.

Statistical Analysis

The results were subjected to statistical analysis. The analysis was done by using students ‘t’ –test at 1% level of significance. The formula employed for the calculation of ‘t’ –test as f follows, “T” – test

$$t = \frac{x-y}{S\sqrt{\frac{1}{n1} + \frac{1}{n2}}}$$

Where,

X = the mean of sample 1

Y = the mean of sample 2

n₁ = the sample size of group1

n₂ = the sample size of group2

S= the standard deviation of the sample.

$$s = \frac{\sqrt{\sum(X-X^2)+\sum(Y-Y^2)}}{n1 + n2 - 2}$$

Results and Discussion

The colour fastness was also conducted with respect to Pressing (Dry and Wet), Crocking (Dry and Wet), and Perspiration (Acid and Alkaline).

Colour Fastness to Pressing

This test was done in order to determine whether the dyed samples showed any colour change and colour transference when subjected to pressing. The test for colour fastness to pressing was done in dry and wet condition on the dyed samples are given in Table – I.

Table 1: Colour fastness to wet pressing

S. NO	Fabric	Dyed Samples	Wet Pressing					
			Colour change			Colour transference		
			Mean	“T” Value	“P” Value	Mean	“T” Value	“P” Value
1	Cotton/ Forest wood union	Manjistha/ Moduka flower	4.4	2.450	0.035*	3.8	2.360	0.039*
2		Catechu	4.2			4.0		

Wet Pressing

Colour Change

The average ratings for colour change of the Cotton/Forest wood union fabric dyed with Manjistha/ Moduka flower and Catechu was found to be 4.4 and 4.2 respectively. There was Very little rate of colour change for was found for both Manjistha/Moduka flower and Catechu and was rated as “Very Good”.

Colour transference

The average ratings for colour transference of the Cotton/Forest wood union fabric dyed with

Manjistha/Moduka flower and Catechu was found to be 3.8 and 4.0 respectively. There was Very little rate of colour change for was found for both Manjistha/Moduka flower and Catechu and was rated as “Very Good”.

Colour Fastness to Crocking

This test was done in order to determine whether the dyed samples showed any colour change and colour transference when subjected to Crocking. The test for colour fastness to pressing was done in dry and wet condition on the dyed samples are given in Table – II.

Table 2: Colour Fastness to Dry Crocking

S. No	Fabric	Dyed Samples	Dry Crocking					
			Colour change			Colour transference		
			Mean	"T" Value	"P" Value	Mean	"T" Value	"P" Value
1	Cotton/ Forest wood union	Manjistha/ Moduka flower	4.8	1.000	0.189	4.1	3.674	0.011**
2		Catechu	5.0			5.0		

**Dry Crocking
Colour Change**

The average ratings for colour change of the Cotton/Forest wood union fabric dyed with Manjistha/Moduka flower and catechu was found to be 4.8 and 5.0 respectively. From the mean value, it was found that there was no rate of colour change was found for both Manjistha/ Moduka flower and Catechu and was rated as "Excellent".

Colour Transference

The average ratings for colour transference of the

Cotton/Forest wood union fabric dyed with Manjistha/Moduka flower and Catechu was found to be 4.1 and 5.0 respectively. There was little rate of colour transference observed for Manjistha/Moduka flower and no rate of colour transference for Catechu and was rated as "Excellent".

Colour Fastness to Perspiration

The test for colour fastness to perspiration was done in acidic condition on the dyed samples. The average ratings of the samples are given in

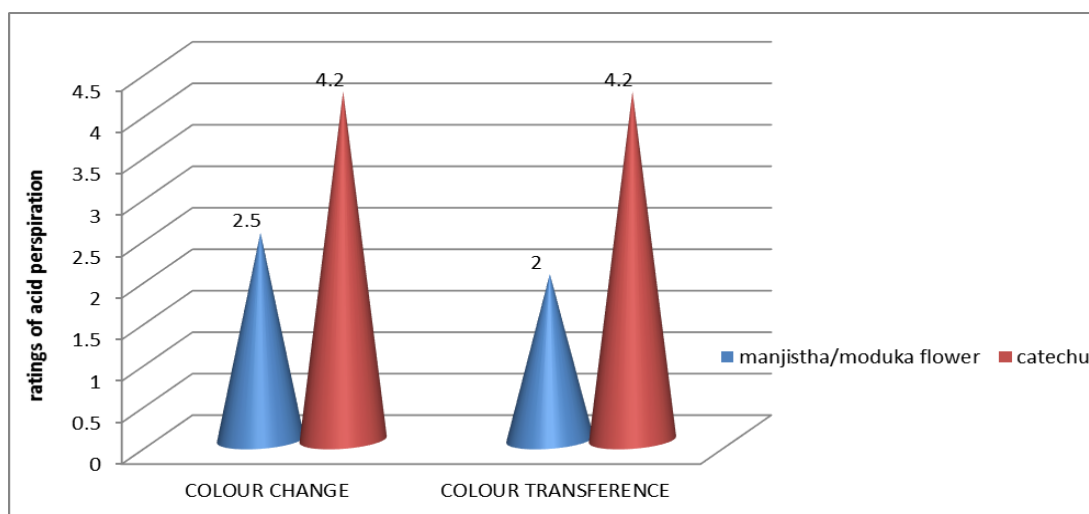


Fig 1: Color fastness to acid perspiration

Acid Perspiration

Color Change

The average ratings for colour change of the Cotton/Forest wood union fabric dyed with Manjistha/Moduka flower and Catechu was found to be 2.5 and 4.2 respectively. From the mean value, it was found that there was a little rate of colour change was found for Manjistha/Moduka flower and rated as "Good" and Very little rate of colour change for Catechu and was rated as "Very Good".

Colour transference

The average ratings for colour transference of the Cotton/Forest wood union fabric Dyed with Manjistha/Moduka flower and Catechu was found to be 2.0 and 4.2 respectively. From the mean value, it was found that there was an appreciable rate of colour change was found for Manjistha/Moduka flower and rated as "Fair" and Very little rate of colour change for Catechu and was rated as "Very Good".

Summary and Conclusion

Natural dyeing is an age old practice. It was the result of quest for man for coloring his body which made him discover for coloring matter from natural sources from such as plants and animals. Most of the natural dyes based on vegetable origin are renewable, biodegradable and eco- friendly.

The Results of the Study Are Summarized As Follows

- Regarding colour change after wet pressing, both Manjistha/Moduka flower and Catechu dyed fabrics showed very little rate of colour change and rated as "Very Good", hence there was very little rate of colour transference in Catechu dyed fabrics and was rated as "Very Good". Thus it can be said that both the fabrics proved to be very good in terms of colour change and colour transference.
- With respect to colour fastness to dry crocking, there was no rate of colour change for both the dyed fabrics and was rated as "Excellent". In terms of colour transference it was proved that Catechu dyed fabrics rated as "Excellent".
- The results for colour fastness tests to acid perspiration showed that, there was very little rate of colour change and colour transference for Catechu dyed fabrics and was rated as "Very Good" compared to Catechu dyed fabrics.

Conclusion

Determining the colour fastness properties, the Manjistha/Moduka dyed fabric showed good colour fastness properties with respect to Wet Pressing, Dry Crocking, Acid Perspiration. It was found that the Catechu dyed fabric showed good colour fastness properties with respect to Wet Pressing, Dry Crocking, Acid Perspiration.

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