



DEVELOPING COLOUR PALETTE ON VISCOSE RAYON WITH NATURAL DYES

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ABSTRACT

The use of natural dyestuffs for dyeing and printing of textiles are preserved by home and craft dyers. There is a multitude of work done on natural fibres dyed with natural dyes. Viscose is an ideal substitute for cotton because of their physiological advantages when viewed in comparison to synthetic fibers. The present study focused on dyeing of viscose rayon with natural dyes using the standardized recipes used for dyeing of cotton to obtain a colour palette. The dyes used were obtained from the waste parts of the plants and trees like dried leaves, bark, stem, etc. The results of the study showed that viscose rayon can take up a good quantity of dye and it also exhibited good fastness properties in terms of light, wash and rub fastness as compared to cotton.

KEYWORDS : Natural dyes, colour palette, pre-mordanting

Introduction

Dyeing is a complex, specialized science. Nearly all dyestuffs are now produced from synthetic compounds. This means that costs have been greatly reduced and certain application and wear characteristics have been greatly enhanced. But many practitioners of the craft of natural dyeing maintain the charm and superior aesthetic quality of natural dyes which is much more pleasing to the eye⁽⁶⁾. Natural dyes are now-a-days in demand not only in textile industry but in cosmetics, leather, food and pharmaceuticals. Today dyeing processes based on natural sources have gained importance in view of stringent environment and industrial safety conditions⁽⁷⁾. The use of natural dyes has gradually gone out of existence from most parts of the country. However in a few places natural dyes continued to be used particularly indigo and alizarin⁽⁸⁾. Special colour effects are achieved in fibre dyed with natural dye with good fastness properties. Also the combination of natural sources with new processes could improve to expand into the value added consumer goods.⁽¹⁰⁾

Natural dyes have been explored more on the natural fibres like cotton, wool, silk and linen. The dyes show good compatibility with natural fibres. The unique and rich colour palette and ease of application with minimum resources have made them more popular in the domestic craft sector as well international market. From the time, regenerated cellulosic fibre viscose rayon introduced in the market, it has secured its place as replacement for cotton fabrics. Its physical properties are similar to cotton, being cellulosic in nature and also have very good drape characteristics for aesthetics of apparel products. Viscose is an ideal substitute for cotton because of their physiological advantages like they are hydrophilic and stand for absorbency and breathability. These fibers are easily dyed in a wide range of colours⁽¹⁾.

Looking at the similarities in the fibre properties, the study was taken to experiment natural dyes on viscose rayon. Similar methods as that of dyeing of cotton with natural dyes were used for viscose rayon.

Materials and methods

A pilot study was conducted by experimenting with various dyes on pre-treated multifibre fabric with and without alum along with the mordant i.e. harda. The concentration of alum for pre-mordanting treatment and harda for mordanting treatment were taken as 10% for the final study. The dyes selected for the final study were manjistha, katha, ratanjyot, flame of the forest, indigo and pomegranate rind. Only pre-mordanting methods were selected for the further research on the basis of the results obtained from the pilot study.

Two fabrics taken for the study were 100% cotton and viscose rayon. These fabrics were scoured, rinsed and dried and tested for their preliminary data using standard test methods before dyeing. Preliminary data of dye and mordants were also collected. Dye materials were collected, cleaned, dried and ground to make fine powder and then boiled for extraction at the MLR of 1:40 for a period

of 45 min. The extraction process was carried out in distilled water to keep extract free from metallic impurities. The recipe was then finalized for the actual dyeing by using the different variables under study. The standard conditions of dyeing were-

– Scouring of the fabric
Detergent and soda ash- 2gm/l
M: L - 1:40
Time- 45 minutes
Temperature- 60°C
Thorough rinsing with tap water.

– Extraction of the dye
% shade- 10% shade
M: L- 1:40
Time- 45 minutes
Temperature- 60°C
Strain with a fine sieve to remove the impurities.

– Pre – treatment of the fabric
1) Myrobalan
% shade- 10% on wt of material
M: L- 1:40
Time- 45 minutes
Temperature-Room temperature
2) Alum
% shade- 10% (W/V)
M:L- 1:40
Time- 30 minutes
Temperature- 60° - 80°C

– Dyeing of the fabric at self pH
% shade- 10% shade
M: L- 1:40
Time- 45 minutes
Temperature- 60°C

– Washing of the dyed fabric in running tap water; up to 3 washes till superficial dye was removed.

The dyed samples were conditioned at the standard atmospheric condition of 65% ± 2% R.H. and 27° C ± C temperatures for the period of 24 hours, before the evaluation tests for fastness.

The following parameters for the dyed samples were assessed:

- Wash fastness
- Light fastness
- Rub fastness
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Determination of wash fastness of dyed samples

The laundering test to evaluate the wash fastness of dyed samples was

carried out in launder-o-meter as per the A.A.T.C.C standard test method IA 61-1962. The change in colour of the treated specimen and the degree of staining of the two pieces of the adjacent fabric was evaluated with the help of grey scales and the ratings were assigned from 1 to 5.

- 1- Poor
- 2- Medium
- 3- Fairly good
- 4- Good
- 5- Excellent/ Very good

The geometric grey scale by ICI (as specified by Society of Dyers and Colorists) was used for visual assessment to evaluate the rate of staining and change in colour of dyed samples.

Determination of light fastness of dyed samples

The light fastness was carried out using Atlas fade-o-meter following the A.A.T.C.C. standard test method 16A-1963. The geometric grey scale by ICI (as specified by Society of Dyers and Colorists) was used for visual assessment to evaluate the rate of fading of dyed samples after standard 5, 10 and 15 hours of exposure to light.

Determination of Rub/Crock fastness of dyed samples

The crocking test to evaluate the rubbing fastness (Dry and Wet) of dyed samples was carried out in the crock-o-meter as per the A.A.T.C.C. standard test method 8, 1991. Colour transferred to the white cloth is assessed by a comparison with grey scale in the A.A.T.C.C. chart for measuring transference of colour. The degree of staining of the piece of white cloth was evaluated with the help of geometric grey scale (staining) and rating were assigned by ICI (as specified by Society of Dyers and Colorists) was used for the visual assessment.

Results and discussion

The cotton and viscose rayon fabrics taken for the study were tested for its preliminary data which included information regarding fiber content, fabric count, weight per unit area and thickness of the fabric.

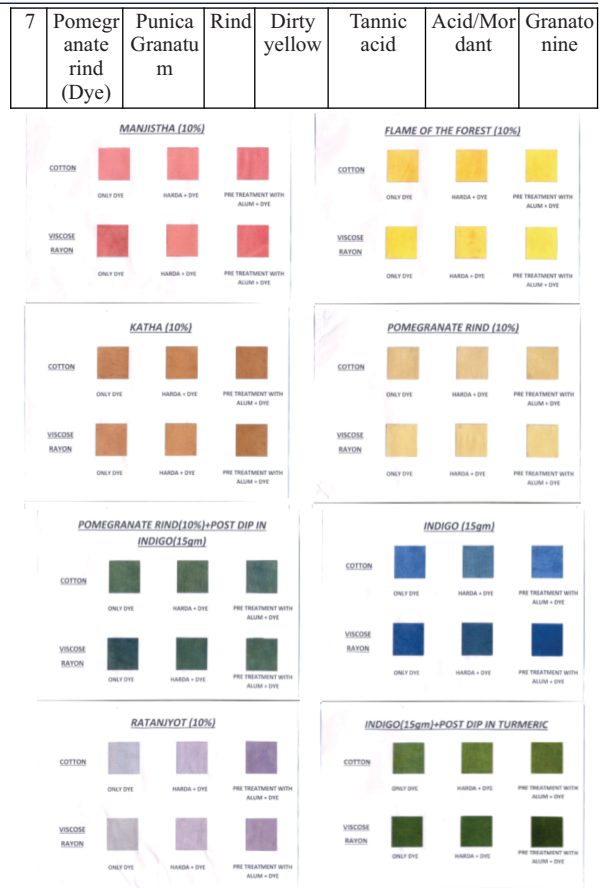
Table 1 : Preliminary data of the fabrics

Sr. No.	Fiber content	Fabric count		Weight/Unit area (gm/m ²)	Fabric thickness (mm)	Weave
		Warp	Weft			
1	100% cotton	64 s	62 s	94.84	25	Plain
2	100% viscose	79 s	72 s	85.24	16	Plain

The details of the selected dyes used for the study were as follows:

Table 2: Preliminary data of the dyes and mordants

Sr. No.	Name of the dyes and mordants	Botanical name	Part used	Colour impart s	Class of dye based on chemical constitution	Class of dye based on its application	Colouring component
1	Turmeric (Dye)	Curcuma Longa	Roots	Yellow	Diferuloyl	Direct	Curcumin
2	Harda (Mordant)	Terminalia Chebula	Powder	Bark-Brown Fruit-Yellow	Quinones	Acid/Mordant	Arjunic acid
3	Indigo (Dye)	Indigofera Tinctoria	Leaves	Blue	Indigoid	Vat	-
4	Katha (Dye)	Acacia Catechu	Wood	Brown	Lannins	Acid/Mordant/Disperse	Chebulinic acid
5	Madder (Dye)	Rubia Cardifolia	Roots	Red	Antraquinones	Mordant/Disperse	Alizarin
6	Ratanjot (Dye)	Onosma Emodii	Roots	Red	Napthaquinones	-	Arnebin



A varied colour palette was developed by different combinations of dyes and the mordants. The three combinations were proposed to use various dyes as follows:

- i. The sample was dyed directly without any mordanting or pre-treatment.
- ii. Sample was treated with harda and then dyed.
- iii. Sample was mordanted with harda and pre-treated with alum before dyeing.

The colour palette of forty eight shades was obtained, twenty four shades on each substrate.

Figure1. Colour palette obtained by three combinations of dyes, pre-treatment and mordants

Fastness properties of the dyed samples on cotton and viscose rayon
 Fastness is the fundamental requirement that coloured textiles should exhibit, to the conditions encountered during the processes following colouration and during their subsequent usage. The fastness requirements, however, are largely determined by the end use of dyed fabrics. Wash fastness, light fastness and rub fastness are the three key factors that fades colour of a textile for commercial use. The fastness to wash, light and rub was tested using grey scale and wash, light and rub was graded from 5-1 indicates excellent-poor fastness to washing, rubbing and light. The results of the fastness tests were as follows:

Table 3: Wash fastness of cotton and viscose rayon dyed with various dyes:

SR. NO.	SAMPLE	COTTON		VISCOSE RAYON	
		Change in colour	Staining on white	Change in colour	Staining on white
1	Manjistha i.Dye	3	2	3	2
	ii.Harda	3	3	3	4
	iii.Alum	4	3	3	4
2	Katha i.Dye	3	4	4	1
	ii.Harda	4	2	3	2
	iii.Alum	4	3	4	3

3	Ratanjyot	5	1	5	1
	i.Dye	5	2	5	2
	ii.Harda iii.Alum	5	3	5	3
4	Pomegranate rind	4	2	4	2
	i.Dye	4	3	4	3
	ii.Harda iii.Alum	3	2	4	3
5	Flame of the forest	3	1	3	1
	i.Dye	3	1	3	1
	ii.Harda iii.Alum	2	1	4	1
6	Indigo	2	4	4	4
	i.Dye	4	2	3	2
	ii.Harda iii.Alum	3	4	4	5
7	Indigo+ post dip in turmeric	2	3	2	4
	i.Dye	2	3	2	5
	ii.Harda iii.Alum	2	3	2	4
8	Pomegranate rind+ post dip in indigo	4	2	3	3
	i.Dye	4	2	3	3
	ii.Harda iii.Alum	4	3	4	3

Out of all the dyes used on cotton, Ratanjyot, Flame of the forest and Indigo + post dip in turmeric exhibited poor wash fastness results.

In case of viscose rayon, Manjistha, Pomegranate rind, Indigo, Indigo + post dip in turmeric, and Pomegranate rind + post dip in indigo showed better wash fastness results.

Table 4: Light fastness of cotton and viscose rayon dyed with various dyes:

Sr. No.	SAMPLE	COTTON			VISCOSE RAYON		
		Rating at 5 hours	Rating at 10 hours	Rating at 15 hours	Rating at 5 hours	Rating at 10 hours	Rating at 15 hours
1	Manjistha	4	4	4	4	3	4
	i.Dye	4	3	3	3	3	4
	ii.Harda iii.Alum	4	4	3	3	3	4
2	Katha	3	4	4	4	3	3
	i.Dye	4	3	4	4	2	4
	ii.Harda iii.Alum	5	4	3	3	3	5
3	Ratanjyot	5	4	-	4	3	-
	i.Dye	5	3	-	4	4	-
	ii.Harda iii.Alum	4	4	-	4	4	-
4	Flame of the forest	3	-	-	3	-	-
	i.Dye	2	-	-	3	-	-
	ii.Harda iii.Alum	3	-	-	3	-	-
5	Indigo	3	4	4	4	5	3
	i.Dye	4	3	4	4	4	4
	ii.Harda iii.Alum	3	4	4	4	5	3
6	Pomegranate rind	4	3	4	4	3	4
	i.Dye	4	4	4	4	4	4
	ii.Harda iii.Alum	3	3	4	4	3	3
7	Indigo + post dip in turmeric	1	1	1	1	1	1
	i.Dye	1	2	1	1	2	1
	ii.Harda iii.Alum	1	3	1	1	2	1

8	Pomegranate rind + post dip in indigo	4	2	4	4	4	4
	i.Dye	4	3	4	4	4	4
	ii.Harda iii.Alum	4	4	4	4	3	3

The above table 4 showed that the fastness property of cotton exhibited poor light fastness results with Ratanjyot, Flame of the forest and Indigo + post dip in turmeric. Viscose rayon showed poor light fastness results for Ratanjyot, Flame of the forest and Indigo + post dip in turmeric.

Table 5: Rub fastness rating of cotton and viscose rayon dyed with various dyes:

Sr. No.	SAMPLES	COTTON		VISCOSE RAYON	
		Staining on white		Staining on white	
		Dry	Wet	Dry	Wet
1	Manjistha	3	3	3	3
	i.Dye	3	3	3	3
	ii.Harda iii.Alum	4	4	4	4
2	Katha	4	4	4	3
	i.Dye	4	3	4	3
	ii.Harda iii.Alum	4	4	3	3
3	Ratanjyot	4	3	4	2
	i.Dye	4	2	4	3
	ii.Harda iii.Alum	4	3	4	4
4	Flame of the forest	2	2	2	2
	i.Dye	2	2	2	2
	ii.Harda iii.Alum	3	2	2	2
5	Indigo	3	4	4	4
	i.Dye	4	3	3	4
	ii.Harda iii.Alum	3	4	4	4
6	Pomegranate rind	4	3	4	2
	i.Dye	4	3	4	3
	ii.Harda iii.Alum	4	3	4	3
7	Indigo + post dip in turmeric	1	2	1	2
	i.Dye	1	2	1	2
	ii.Harda iii.Alum	1	2	1	3
8	Pomegranate rind + post dip in indigo	4	3	4	4
	i.Dye	4	3	4	4
	ii.Harda iii.Alum	4	3	4	4

The rub fastness results of all the dyes used on cotton, ratanjyot and indigo + post dip in turmeric only gave poor results of rub fastness.

Flame of the forest and indigo + post dip in turmeric on viscose rayon gave poor results of rub fastness.

The above results showed that viscose rayon can take up a good quantity of dye and it also exhibits good fastness properties in terms of light, wash and rub fastness as compared to cotton. The performance of the selected dyes namely manjistha, katha, pomegranate rind, indigo and their combinations like pomegranate rind + post dip in indigo showed relatively good results. The other dyes namely ratanjyot, flame of the forest and indigo + post dip in turmeric showed comparative poorer results.

Based on the previous studies carried out in the department on cotton, the results on cotton and viscose rayon were almost the same. Natural dyes can be used on viscose rayon to develop a colour palette similar to that of cotton.⁽⁷⁾

On the basis of all the results, it was found that viscose rayon can take up natural dyes very positively as compared to the cotton because it has

many similarities with cotton like its feel, drape, fall and the most important property of dye absorbency.

Conclusion

The scenario of natural dyeing is gradually making its own way in the global market and the production of eco-friendly naturally dyed textiles itself is a boon to save the environment from hazardous synthetic dyes. Further, the information generated on shades of various dyes used, physical properties and colour fastness properties on the viscose rayon fabric help to produce textile for various applications.

Viscose rayon which works as a substitute for the cotton fabric can help in adding a variety to the traditional textile market. Viscose rayon can work as a good base for various traditional textile craft like Ajrakh, Bandhni, Batik, etc. and it can help the artisans to add a variety to the already existing product range of the textiles in the market. It can also be useful for the rayon industries to venture into the eco-friendly product market help to build a bridge between the industry and the craft clusters for the use of natural dyes.

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