Journal of Textile and Fashion Technology (JTFT)
Vol. 2, Issue 1, Jun 2016, 19-28

TRANS STELLAR
•Journal Publications •Research Consultancy

ECO-FRIENDLY DYEING ON LINEN FABRIC

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ABSTRACT

Colour is one of the elements of nature that made the human living more aesthetic and fascinating in the world. They are supposed to be associated with emotions, human qualities, seasons, festivals and passion. Colour is an element, which transforms the entire life of fabric. It is the property that is noticed and is frequently the first factor governing fabric choice, says Manisha Gajlot.

KEYWORDS: Human Living, Human Qualities, Seasons, Festivals and Passion

Received: Mar 09, 2016; **Accepted:** May 26, 2016; **Published:** Jun 14, 2016; **Paper Id.:** JTFTJUN201603

Original Article

INTRODUCTION

The knowledge and the use of colour on textiles is one of the most important processes of fabric development and utilization. It was the result of the quest of man for beauty of coloring matter from natural sources such as plants and animals. The term natural dye covers all the dyes derived from natural resources like plants, insects and minerals, state Padhye and Rathi (1990).

The discovery of many synthetic dyes followed quickly and flooded the markets of not only in Europe, but also in Japan, Egypt and other countries, which were originally, dependant on India for natural dye sources, says Gahlot, and Knur (1996).

The art of dyeing with natural dyes has gained momentum, not only for the safety of health and environment but also for the beauty and novelty, states V.K.L.T. Katyayini. natural dyes are safer, No hazards, easy disposal, eco-friendliness and some dyes have medicinal properties that will improve value addition to the product and may be categorized under smart textiles, opines P.Senthil Kumar.

Almost, all the synthetic dyes have their origin in coal for the synthetic dyes are being criticized for causing water pollution and waste disposal problems. Synthetic dyes involve the use and release and enormous amount of hazardous chemicals to the environment during their productions and use. The synthetic dyes and other chemicals used during the manufacturing process are very harmful for human skin and human health, points out Padma S. Vankar (2001).

The importance of natural dyes is realized worldwide because of its eco-friendliness, easy application and abundant availability. Various attempts have been made globally to extract natural dyes from different natural resources, and to apply on textile materials. In this work the dyes extracted from gulmohar leaves and apply on textile material. Different dye shades were produced on linen using pomegranate mordant and mordanting method (pre-mordanting) the dyeing is carried on linen. The fastness properties of the dyed materials are also analysed in

this thesis.

The Main Objectives of the Study Are

The understand the eco-friendliness of natural dyes extracted from the GULMOHAR LEAVES.

To apply natural dyes on linen fabric with pomegranate mordant technique.

To analyze the fastness and strength properties of the dyed material.

EXPERIMENTAL PROCEDURE

Selection of Fabrics

The selected fabric is linen. Linen is the granddaddy of all natural fibers, linen naturally boasts a fair amount of tips and general rules of thumb regarding its proper wear and care. The first to know about linen are that clothes made from the fabric are mostly casual, and that pure linen wrinkles very easily. The fabric also lends itself well to few major clothing types.

Linen suits have a long history as the mark of the vacationing gentleman, particularly in the American South and the Mediterranean. Not only does a linen suit's breezy elegance turn women's heads, but a good linen suit marks its wearer as that rare man who manages to look laid back and classy, even during summer's hottest, muggiest months.

Italian and Irish linen are the two best-regarded types of linen used in the making of linen suits and blazers. Irish linen has history on its side, and is considered the superior-not to mention heavier, and therefore, less wrinkle-prone-of the two.

And because of linen's loose-fitting nature, linen suits do not necessarily require traditional tailoring. If you're on a budget, you can comfortably buy a linen suit off the rack. You can also save additional money by buying offseason, in the fall or winter.

Fabric Particulars

Table 1: Fabric Particulars

1	Fabric	Linen
2	Composition	100% Linen
3	Ends/inch	50
4	Picks/inch	50
5	Count	50's
6	Width of the fabric	120"

PREPARATON OF FABRICS

The easiest way to dye linen is to start with, bleached, and mercerized seines, as all the preliminary stages will have been already carried out. For the dyer who wishes to start with unbleached linen the following process is necessary

- Desizing
- Scouring
- Bleaching

DESIZING

Table 2: Desizing

Wetting agent	1:60
Temperature	60°C. 90°C
Time	1½ hrs
pH	3-4

Weight of the fabric is determined by using weighting balances and the amount of hydrochloric acid and water will be calculated. The desizing bath is setup with material liquor bath, maintaining temperature 1½ hour. Then the material is washed and rinsed using cold water and dried.

SCOURING

Scouring is almost invariably the first wet process applied to textile materials. The object is to remove oils, fats, waxes, soluble impurities and any particulars or solid dirt adhering to the fibers natural cotton, unlike raw wool, contain only a comparatively small proportion of impurities.

Table 3: Scouring

Scouring agent	100%
Sodium carbonate	2%
Wetting agent	2%
Temperature	100°C
Time	1½ hrs
M:L:R	1:50
pH	13

The weight of the sample is calculated. The bath is set up with required amount of material liquor ratio. After the sodium hydroxide, wetting agent, sodium carbonate was added to the bath the temperature maintained at 100°C for 1½ hour. After that, the fabric is taken out and given cold was and dried.

BLEACHING

If a clear, light color is required after dyeing, bleaching is essential.

There are a number of householder bleaches on the market that would be suitable. Follow the instructions given by the manufacture and make up a bleaching bath using a stainless steel, galvanized or earth were vessel. Use water in the usual ratio of 1:30, so 4 liters of water will be satisfactory for 120g of linen.

Table 4: Bleaching

Sodium hypo chloride	1%
Sodium chloride	1%
Temperature	100°C
Time	1½ hrs
M:L:R	1:60
pH	11.5

Enter the wetted-out skeins for 2-3 hours. Turn them occasionally with a glass rod or a clean, smooth wooden rod, making sure that the liquid penetrates the material evenly. Remove the fabrics from bleach, squeeze them and expose to air

for a few hours.

This process can be repeated until the fabric is white enough for dyeing, the rinse very thoroughly.

SELECTION OF DYE SOURCES

The leaves of gulmohar tree were the dye sources selected for the study owing to their easy availability and also for getting the different shades.

The botanical name of these dye and also the parts from which the dye is extracted from these sources are shown.

Table 5: Dye Source Selected

S.NO	COMMON NAME	BOTANICAL NAME	PARTS USED
1	Gulmohar Tree	Delonix Regia	Leaves

SELECTION OF MORDANTS

The majority of natural dyes need a chemical in the form of a metal salt to create an affinity between the fiber and the pigment. The chemicals are known as mordant. The mordants help to produce faster shades by forming an insoluble compound of mordant and dye stuff with in the fiber. The nature mordants are eco-friendly mordants. So natural mordants are selected. The mordant is pomegranate. It is eco-friendly mordant. Hence, these mordant were selected for the study on their availability.

Table 6: Mordant Selected

S.NO	COMMON NAME	BOTANICAL NAME	TRADE NAME	PARTS USED
1	Pomegranate, Anaar	Punica Granatum	Mallow	Peel

LPP

The first letter **L** indicates linen, the name of the material for study.

The second letter **P** indicates the selected mordant namely pomegranate respectively.

The third **P** indicates the mordant technique pre-mordant.

DYEING

Preparation of Dye Powder

The gulmohar leaves were collected and these were dried in shade. The dried leaves were powdered and used for dyeing.

EXTRACTION OF DYES

To extract the dyes from its sources the following steps were followed.

The amount of dye powder was taken according to the material weight. The dyed powder was boiled in water with material-liquid ratio 1:10 for half an hour. After that, it was filtered to get the dye solution.

The dyeing methods were followed:

- Alkali method

ALKALI METHOD

Alkali method of dye extraction was followed by taking 5 gms of dried skin powder in 100ml of water containing 1 gram of urea, per 1 gram of fabric for half an hour.

MORDANTING

Mostly natural dyes are mordant dyes. The selected mordant is pomegranate. The selected mordant technique are pre-mordanting.

PRE-MORDANTING

Known weight of Linen fabric were first mordanted and then dyed.

MORDANTING CONDITIONS

Mordant used	:	Pomegranate
Mordant concentration	:	2 %
Salt concentration	:	2 %
Temperature	:	90°C
Time	:	30 minutes
Material: liquor	:	1:10

DYEING CONDITIONS

Dye Used	:	Gulmohar leaves
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ACTUAL DYEING

Prior to dyeing, each of the samples was soaked in water, excess water was removed, and the sample was shaken well to remove creases. Then the sample immersed in the mordant for half an hour. Then taken out and again immersed in to the dye extract and boiling for half an hour. Later, it was taken out and washed and dried. The same procedure was followed for all the samples.

AFTER TREATMENT

After immersing the fabric in the dye solution for half an hour it was taken out and rinsed several times in fresh water and dried.

LABORATORY TESTS

EVALUATION

The natural dyed samples were evaluated as follows:

VISUAL EVALUATION

A panel of 18 postgraduate students specializing in the field of costume designing and fashion were selected as judges for rating the samples. General appearance, brightness of color, evenness of dyeing, texture and luster were the main aspects taken into consideration for visual evaluation.

FABRIC WEIGHT

This test method covers the measurement of fabric's mass per unit area (weight) and is applicable to most fabrics. Metter PM 200 electrical balance was used to determine the weight of the sample. It had readings in digital count. The samples were cut at random from different places of the material using a template. Each cut sample was weighted and the readings were recorded. The readings were noted from the samples and the mean weight was calculated. This was expressed in grams/square meter (GSM).

FABRIC THICKNESS

Thickness of a specimen of a woven fabric is measured as the distance between the reference plate on which the specimen rests and a parallel circular pressure foots that exerts a specified pressure on the area under test.

The Mijutoya thickness tester was used. It has two parts, the anvil and the pressure foot, earlier worked under a pressure foot and later worked under a level spring action. On the top, a dial indicated the thickness of the sample in thousands of an inch.

Each division on the dial read 0.01 mm. The sample was placed between anvil plates. Selvedges and creased areas should be avoided. The indicated the thickness of the sample. The readings were taken from different places of the sample and the mean was calculated. Fabric thickness is mainly used for checking the conformity of the specification.

FABRIC TEARING STRENGTH

Breaking strength is the force required to break a fabric when it is under tension. Breaking elongation is the increase in length that has occurred when the fabric breaks. Grover and Hamby (1969) define breaking strength as a measure of the resistance of the fabric to a tensile load or stress in either the wrap or filling direction. Elongation measures the extent of deformation along the axis of a material under a tensile strength.

Is (1969) Grap tester was under for the study. It is one of the automatic machine. Ten samples were cut from the warp and weft direction. Each sample was 6" in length and 4" in width. Each sample was clamped between the jaws. It was important that both the clamps the load was applied catch the same ends and as soon as the sample was broken, the readings were recorded in force and elongation in percentage. Ten such readings were taken and the mean strength and elongation were found out.

PH Test

PH value is one of the ecological tests. To find the PH value the method followed was is (1390) cold method. Two grams of each fabric was cut into small pieces and immersed in the 100 ml of distilled water. After an hour filter each

sample solution was filtered and the PH value was found out with the help of the PH scale.

COLOUR FASTNESS TEST

FASTNESS

The colour fastness of a coloured textile is, therefore defined as it is resistance to these changes when subjected to a particulars set of conditions. It follows that color fastness must be specified in terms of these changes and expresses in terms of the magnitude. The importance of colourfastness depends on the use of the fabric.The following colourfastness tests were conducted to determined the colourfastness of the dyed samples.

- **COLOUR FASTNESS TO WASHING**
- **COLOUR FASTNESS TO LIGHT**
- **COLOUR FASTNESS TO RUBBING**

- **COLOUR FASTNESS TO WASHING**

The test samples of 2" x 4" size were cut from the material. Each sample was sandwiched between the undyed samples, which have been desized well. Soap solution of about 4 gms/litre was prepared. Each of the test samples was soaked in the soap solution, separately for about half an hour. After that, the test samples were removed, rinsed in cold water thoroughly squeezed well and dried. The colour change and staining of the samples were assessed in compression with the grey scale.

- **COLOUR FASTNESS TO LIGHT**

Majority of colour become light in hue when exposed to light and some become dark. A sample 8" x 2" was cut from the material. The eight inches portion was divided exactly into eight divisions of one-inch width. The strip was covered with chart paper. Then the chart papers are fixed in the sample holder. The holder is clamped with the xenon-test Atlas machine. After six hours, the test samples were assessed in comparison with the grey scale.

- **COLOUR FASTNESS TO RUBBING**

For testing of fabric IS 766 method was selected. Crocking is the transferable of colour by rubbing from one coloured textile material to another. A wet fabric will crock more easily than dry one because the moisture present assists in removing dye states pizzute (1995) Sasmina crock meter was mounted into the rubbing finger with a ring. Each sample was given ten rubs based on the standardization. A damp white material was used for wet crocking. The procedure adopted was same as that of dry crocking. The colour change and staining of the samples were assesses in comparison with the grey scale.

RESULT AND DISCUSSIONS

Visual Evaluation

The result of visual evaluation of linen samples are presented in table 7

Table 8: Visual Evaluation of Dyed Samples-Linen

SAMPLES	GENERAL APPEARANCE			BRIGHTNESS OF COLOUR			TEXTURE			LUSTER		
	Good	Fair	Poor	Bright	Medium	Dull	Fine	Medium	Coarse	Good	Fair	Poor

Table 8: Contd.,												
LPP	78	22	0	70	30	0	24	76	0	0	11	89

VISUAL EVALUATIONS

The general appearance of the sample was visually evaluated. The sample considered good by above 75% to 90% of the judges and fair by 52% of the judges. The brightness of colour of the sample was visually evaluated. The sample considered good by above 62% to 82% of the judges and fair by 40% to 60% of the judges. The sample were rated as evenly dyed. Most of the judges rated the texture as medium and the luster as good all cases.

LABORATORY TEST

The fabric weight of linen samples is shown in table 8

FABRIC WEIGHT

Table 9: Fabric Weight-Linen

S.NO	SAMPLES	MEAN FABRIC WEIGHT(OUNCES/SQUARE YARD)	GAIN OR LOSS OVER ORIGINAL	PERCENTAGE GAIN OR LOSS
1	Original	102.7	0	-
2	LPP	132.0	+29.3	28.5

FABRIC WEIGHT

On dyeing with natural colour of the fabric weight of the sample was maximum increased. The dyed sample LPP was rated as first. The rest of the sample was rated as low. It is evident that the fabric weight of linen can be increased over the original when dyed. Use of pomegranate as mordant had increased the fabric weight of sample appreciable irrespective of the dye.

FABRIC THICKNESS

The fabric thickness of linen samples is shown in table 10.

Table 10: Fabric Thickness-Linen

S.NO	SAMPLES	MEAN FABRIC WEIGHT(OUNCES/SQUARE YARD)	GAIN OR LOSS OVER ORIGINAL	PERCENTAGE GAIN OR LOSS
1	Original	0.22	0	-
2	LPP	0.24	+0.02	9.1

FABRIC THICKNESS

From the above table, it is obvious that sample LPP maintained fabric thickness same as that of the original sample. The fabric thickness of linen was maintained when dyed with pomegranate as mordant. Pomegranate maintained the fabric thickness of linen when dyed with gulmohar leaves.

FABRIC TEARING STRENG

The fabric tearing strength of linen samples are shown in table 10.

Table 11: Fabric Tearing Strength-Linen

		WARP			WEFT		
S.NO	**SAMPLES**	**MEAN STRENGTH IN KGS**	**LOSS OR GAIN OVER ORIGINAL**	**PERCENTAGE GAIN OR LOSS**	**MEAN STRENGTH IN KGS**	**LOSS OR GAIN OVER ORIGINAL**	**PERCENTAGE GAIN OR LOSS**
1	Original	6.35	-	-	6.25	-	-
2	LPP	6.33	-0.02	0.31	6.34	-0.09	1.44

TEARING STRENGTH

Sample LPP decrease the tearing strength of the original in the warp direction.It is evident that sample dyed with pomegranate with pre-mordant technique increases the fabric strength.In the weft direction LPP decrease the strength over the original while the rest increase. Gulmohar leaves showed minimum loss 0.16 percent when dyed with pomegranate in pre-mordant technique. The warp strength increases over the weft strength.

pH VALUE TEST

Table 12: Ph Value Test

S.NO	SAMPLES	pH VALUE	RESULT
1	LPP	7.5	FAIR

COLOUR FASTNESS TEST

Table 13: Colour Fastness Test-Linen

SAMPLES	COLOUR FASTNESS TO LIGHT (CFTL)	COLOUR FASTNESS TO WASHING		COLOUR FASTNESS TO RUBBING			
				DRY		WET	
		COLOUR CHANGE (CFTW1)	STAINING (CFTW2)	COLOUR CHANGE (CFTRD1)	STAINING (CFTRD2)	COLOUR CHANGE (CFTRW1)	STAINING (CFTRW2)
LPP	4	2/3	5	4/5	5	4	4/5

Table 14: Colour Fastness Test-Linen Abstract of Results

S.NO	SAMPLE NAME	LPP
1	General appearance	78
2	Brightness	70
3	Texture	24
4	Luster	11
5	Fastness to light	4
6	Fastness to washing	2/3
7	Fastness to rubbing dry	4/5
8	Fastness to rubbing wet	4
9	Tearing strength warp	0.31
10	Tearing strength weft	1.44
11	Fabric thickness	9.1
12	pH value	7.5
13	Fabric weight	28.5

COLOUR FASTNESS TEST-LINEN

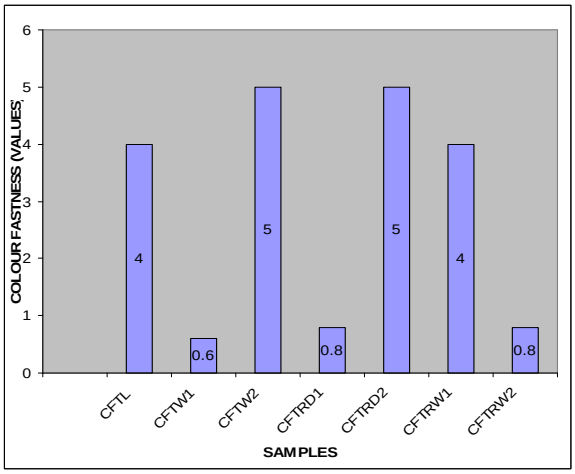

Figure 1

CONCLUSIONS

From the study, it may be concluded that the selected dye sources namely gulmohar tree leaves are highly suitable for linen material with pomegranate mordant. The pre-mordant techniques are mostly suitable for linen material. These dyes are safe and eco-friendly. Therefore, their use will definitely minimize the health hazards caused by the use of synthetic dyes. These natural dyes give some medicinal properties also.

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