



Study of Eco-friendly Natural Dyeing on Milk Fabric by Using Medicinal Herb Kalanchoe Pinnata

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Abstract :

Dye is an aesthetic substance that is used to colour the fibre and fabrics that is used in our day-to-day life. Dyes may be either natural or synthetic and both these dyes are used for dyeing fibres, yarns and fabrics. Presently there is a great demand for the use of natural colours throughout the world. Natural dyes are the best suiting option for the green clothing as these are eco-friendly, renewable, safer and sustainable way of colouration. Present research is an attempt to explore colouring behaviour of medicinal herb namely kalanchoe pinnata on milk fabric. K.Pinnata herb show great affinity for the milk fabric. Mordanting of the fabric was carried out using three mordanting technique i.e. pre, meta and post-mordanting using natural mordants i.e. Harda Powder, Dry Goose Berry Powder, Orange Peel Powder, Banana Peel Powder, Pomegranate Peel Powder, Onion Peel Powder, Lemon Peel Powder, Beetroot Peel Powder, Carrot Peel Powder, Lychee Peel Powder, Dyed samples were further analyzed for colour strength and fastness properties against wash, rubbing and light. K.Pinnata give a wide colour spectrum in yellow-green region with moderate to excellent fastness properties. Antimicrobial behavior of dye extract is excellent against both gram positive and gram negative bacteria showing extensive application in medical textile such as dresses of doctors, patients, bandages for wound care, bed-sheets and curtains in hospitals. Thus, findings of study showed that kalanchoe Pinnata leaf extracts has potential to be used as natural dye for colouration of textiles.

Keywords: Natural dye, Kalanchoe Pinnata, dye extraction, mordant, Milk, colour value, colour fastness.

1. Introduction

Today the protection of environment has become a challenge for the chemical industry worldwide. Synthetic dyes effluents that are discharged in the river or emitted into the atmosphere result in environmental pollution and control of effluents continue to be a problem and another way natural dyes are eco-friendly and do not create any pollution and waste obtained in process become an ideal fertilizer. Natural dyes are known for their soft, lustrous colours, endurance and the application of herbal dyes on the textile substances will give a new direction towards the treatments of various diseases through textile industry As the clothes are in touch with human

body for Twenty four hours, therefore it should be important that textile should not be harmful to human body. When the fabric dyed with medicinal herb, the medicinal values of herbs will remain in clothes intact because dyeing is done without chemicals Textile Dyeing with kalanchoe Pinnata clear the dyeing concept and it prevents and cure numbers of diseases and gives protection against cancer, skin disease, respiratory diseases due to having numerous useful and effective medicinal properties, such as antibacterial, allergic, antiseptic, anti-inflammatory, antidiabetic, wound healing, neuropharmacological etc.

Pharmacological activities of herb: Herbal tonic, Antileishmanial activity, Hepatoprotective, nephroprotective Neuropharmacological activities, Anti-mutagenic activity, Antihypertensive activity, Analgesic, Anti-inflammatory, Wound healing activity, Toxic to cattle Insecticidal Fungi toxic, Phototoxic activity, Anticancer, Anti bacterial, Anti oxidant, Anti microbial, Anti diabetic, Anti ulcer, Anti-depressant, Creatine kinase, Neurosedative/muscle relaxant.

Fabric	Specification	Milk Fabric
	EPI	42
	PPI	33
	Weight (Gsm)	58
	Count	Warp-5.9 Tex Weft-10.2Tex

Price: In the Indian Market price

of kalanchoe pinnata is 250 Rs of 100 gram. (In this present research kalanchoe Pinnata collected from the local agricultural area and campus of university)

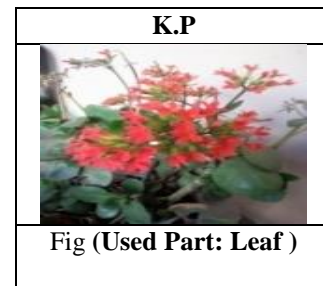
2. Aim and objectives of the study: The aim of study was to explore sustainable natural colourants. Extracted colour was further used to explore dyeing of Milk fabric. Different natural mordants were used producing brilliant shades card. Fastness a properties of dyed fabrics was further assessed to check efficiency of colourants. The objectives of the study were as follows:

Objectives:

- To dye milk fabric with selected medicinal herb Kalanchoe Pinnata.
- To study the dyeing effects of kalachoe Pinnata .
- To assess the effect of various natural mordants.
- To assess colour fastness properties of the dyed fabric.
- To assess the antimicrobial property against gram positive and gram negative bacteria.

3. Material and Method

a) Herbs collection: -Kalanchoe Pinnata collected from University campus and local agricultural area.



b) Mordants Powder: “Natural Mordant Powders” were purchased form Amazing Enterprises, Bangalore (Karnataka).

C) Mordants: H.P-Harda Powder, D.G.B.P-Dry Goose Berry Powder, O.P.P-Orange Peel Powder, B.P.P-Banana Peel Powder, P.P.P-Pomegranate Peel Powder, O.P.P*-Onion Peel Powder, L.P.P-Lemon Peel Powder, B.P.P*-Beetroot Pee Powder, C.P.P-Carrot Peel Powder, L.P.P*-Lychee Peel Powder

d) Textile substrate: Milk Fabric purchased from **Pahartah Fashion LLP Himachel Pradesh**. The specification of the fabrics shown in Table

e) Dye extracted by aqueous Extraction Method

Dry leaves of kalanchoe pinnata ---Grinding---boiled in water ---filtration ---oven dry ---fine powder used as natural dyeing agent

f) Optimized Dying recipe of k.pinnata

M.L.R- 1:30
K.pinnata- 20% owf
Natural mordant - 20 % owf

(H.P-Harda Powder, D.G.B.P-Dry Goose Berry Powder, O.P.P-Orange Peel Powder, B.P.P-Banana Peel Powder, P.P.P-Pomegranate Peel Powder, O.P.P*-Onion Peel Powder, L.P.P-Lemon Peel Powder, B.P.P*-Beetroot Pee Powder, C.P.P-Carrot Peel Powder, L.P.P*-Lychee)

PH - 5-6.5

Temp. - 90°C

Time - 60 Min.

f) Applying method

Applied by shaker method using water bath shaker machine as shown in figure 11 at 65 rpm speed in borosil conical flask.

4. Result ad Discussion

1. Rubbing Fastness

This method is intended for determining the transfer of colour and the behaviour of the surface of a fabric on rubbing with an undyed wool felt using crock meter tester as shown in table :

- No. Of rubbing cycles – 10 (as per AATCC 8 test standard)
- Fabric tests condition – i) dry state ii) wet state
- The rubbing (crock meter) fastness was ratted from 1 to 5. Rating 1 shows very

poor rubbing fastness whereas maximum

rating 5 shows excellent rubbing fastness.

Rubbing Fastness		Pre Mordanting		Meta Mordanting		Post Mordanting	
Sr no	Mordant Name	Dry Rubbing	Wet Rubbing	Dry Rubbing	Wet Rubbing	Dry Rubbing	Wet Rubbing
1	Without mordant	5	5	5	5	5	5
2	H.P-Harda Powder	4.5	4	4.5	4	4.5	4
3	D.G.B.P-Dry Goose Berry Powder	4.5	4	4.5	4	4.5	4
4	O.P.P-Orange Peel Powder	5	4.5	5	4.5	5	4.5
5	B.P.P-Banana Peel Powder	4.5	4	4.5	4	4.5	4
6	P.P.P-Pomegranate Peel Powder	4.5	4	4.5	4	4.5	4
7	O.P.P*-Onion Peel Powder,	4.5	4	4.5	4	4.5	4
8	L.P.P-Lemon Peel Powder	5	5	5	5	5	5
9	B.P.P*- Beetroot Pee Powder	4.5	4	4.5	4	4.5	4
10	C.P.P-Carrot Peel Powder	4.5	4.5	4.5	4.5	4.5	4.5
11	L.P.P*-Lychee Peel Powder	5	5	5	5	5	5

Result: Very good to excellent rating of Dry and wet rubbing.

These three mordanting method equally best to got very good to excellent rubbing fastness properties.

2) Light fastness test

This method is intended for determining the resistance of the colour of material to the action of a standard artificial light source. The xenon lamp has an emission wavelength profile close to daylights per AATCC 16 test standard.

• **Testing machines used-**Digital light fastness tester for light fastness.

• Exposure time 40 hrs as per AATCC 16-2004 standard.

Light Fastness				
Sr no	Mordant Name	Pre Mordanting	Meta Mordanting	Post Mordanting
1	Without mordant	6.5	6.5	6.5
2	H.P-Harda Powder	6	6	6
3	D.G.B.P-Dry Goose Berry Powder	6	6	6
4	O.P.P-Orange Peel Powder	6.5	6.5	6.5
5	B.P.P-Banana Peel Powder	6	6	6
6	P.P.P-Pomegranate Peel Powder	6	6	6
7	O.P.P*-Onion Peel Powder,	6	6	6
8	L.P.P-Lemon Peel Powder	6.5	6.5	6.5
9	B.P.P*- Beetroot Pee Powder	6	6	6
10	C.P.P-Carrot Peel Powder	6.5	6.5	6.5
11	L.P.P*-Lychee Peel Powder	6.5	6.5	6.5

Result: Moderate to excellent rating of light fastness .

These three mordanting method equally best to got moderate to excellent light fastness properties.

3.Wash fastness test

The resistance of a material to change in any of its colour characteristics,

when subjected to washing is called colour fastness to washing.(wash fastness is the way to assess the washing behaviour of dyed textile

substrate depending on number of washes as per specification of IS:3361-1984)

- **Wash fastness tester:** -Wash fastness tester is used for determining colourfastness of textile material to washing.
- **Washing procedure:** -A 10 x 4 cm swatch of the coloured fabric is taken and is sandwiched between two adjacent fabrics and stitched, the sample and the adjacent fabric are washed together as per test standard.(Adeel S., et al 2011)

M: L: R - 1:30
Specimen size - 10 x 4 cm
Washing severity -mild washing
Detergent(Lissapol N) -5gpl
Time -30 min

Temp -50°C
Time: 45 min
Still ball-no

Grey scale -for assessing change of colour
a) **For hot wash – mild hot water**

b) **Cold wash- mild cold water**

c) **Staining and fading wash – Mild water , with cotton and wool fabric**

M: L: R - 1:30

Specimen size - 10 x 4 cm

Washing severity - mild washing

Detergent (Lissapol N)-5gpl

Time - 30 min

Temp- 40°C

Grey scale - for assessing change of colour

After soaping treatment, specimen, rinse twice in cold water and then in running cold water under a tap. Squeeze it and air dry at a temperature not exceeding 60°C. The change in colour and staining is evaluated with the help of grey scales as per test standard. (Goodarzian H et al 2010)

Wash Fastness		Pre Mordanting		Meta Mordanting		Post Mordanting	
Sr no	Mordant Name	Colour change	Colour stain	Colour change	Colour stain	Colour change	Colour stain
1	Without mordant	5	5	5	5	5	5
2	H.P-Harda Powder	5	4	5	4	5	4
3	D.G.B.P-Dry Goose Berry Powder	5	4	5	4	5	4
4	O.P.P-Orange Peel Powder	5	4.5	5	4.5	5	4.5
5	B.P.P-Banana Peel Powder	5	4	5	4	5	4
6	P.P.P-Pomegranate Peel Powder	5	4	5	4	5	4
7	O.P.P*-Onion Peel Powder,	5	4	5	4	5	4
8	L.P.P-Lemon Peel Powder	5	5	5	5	5	5
9	B.P.P*- Beetroot Pee Powder	5	4	5	4	5	4
10	C.P.P-Carrot Peel Powder	5	4.5	5	4.5	5	4.5
11	L.P.P*-Lychee Peel Powder	5	5	5	5	5	5

Result: Very good to excellent rating of colour change and colour stain.

These three mordanting method equally best to got very good to excellent wash fastness properties.

4. Computer colour Measurement:
Colour correlation matrix

Computer colour measurement (CCM) is the instrument which measure the colour attributes and predict the dyeing recipe

using the spectrophotometric properties of dyestuff and fibres.

The basic three things are important in ccms :-

1. Colour measurement instrument (spectrophotometers).
2. Reflectance (R %) from a mixture of dyes or pigments applied in a specific way.
3. Optical model of colour vision to closeness of the colour matching (CIE L*a*b).

- AATCC test method 110, “whiteness of textiles,” lists procedures for instrumentally measuring and calculating whiteness and tint of fabrics.
- AATCC test method 173, “CMC: calculation of small colour differences for acceptability,” describes how to calculate and use the de cmc colour difference scale.

Colour correlation matrix (Standard milk fabric (undyed) and Dyed milk fabric without mordant)			
Sr no	CCM Values	Standard milk fabric (undyed)	Dyed milk fabric (without Mordant)
1	L	77.190	61.150
2	A	0.621	4.669
3	B	1.153	14.061
4	C	1.310	14.816
5	H	118.332	71.602
6	DL	-2.276	18.316
7	DA	0.443	5.733
8	DB	5.085	7.823
9	DC	-5.018	8.488
10	DH	0.932	-4.693
11	DE	5.589	20.725

Kalanchoe pinnata natural dye gives various shades in green yellow region on milk fabric with the help of various natural mordants.

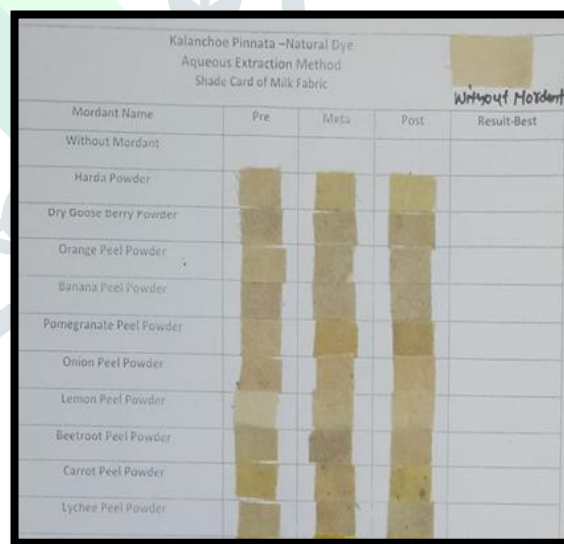
The colour difference DE, colour value (L*, a*, b*) of the different dyed samples were determined using data colour spectrophotometer and data colour software interfaced with the computer illuminant D65, observer 10⁰ and CIE 1976. The instrument was standardized with a white tile. Hunter co-ordinates l*, a*, b* have been measured on the instrument of various samples where,

L signifies lightness (L+ -- more lighter, L- -- more darker)

a signifies redder or greener (a+ -- redder, a- -- greener)

b signifies bluer or yellower (b+ -- yellower, b- -- bluer)

Shade Card



5. End Use Application: Due to wide applications of synthetic dyestuffs on variety of fibres and fabrics, it causes many environmental pollutions and harmful effects because of their toxic degraded products and non-biodegradable nature. Some serious health hazards like allergenicity and carcinogenicity are caused due

to the usage of synthetic dyes. And due to this, some of synthetic dyes were banned. Hence it is essential to revive world heritage and traditional wisdom of using safer natural dyes. As most of the consumers always rely on sustainability, the natural dyes are gaining more importance as they are obtained from renewable resources, eco-friendly and free from health hazards and some of them act as incredible health care products too.

- Dyed fabric can be used in medical textile to make bandage for care of wound.
- Dyed Milk fabric can be used form men shirts, women suits.
- Antimicrobial behavior of dye extract is excellent against both garm positive and gram negative bacteria showing extensive application in medical textile such dress and gloves of doctors, bed-sheets and curtains in hospitals. So Treated fabric will be the best dyed fabric with finishing treatment of antimicrobial activity for dress of doctors, patients and furnishing of hospital textile. At the level where scientific developments stand today, natural dyes are a sustainable option only for small-scale applications and they can only complement synthetic dyes. They can be considered as best suitable on the cottage

level, for small scale industries, manufactories, hobby groups, and craftsmen.

6. Conclusion : Kalanchoe pinnata natural dye gives various shades in green yellow region on milk fabric with the help of various natural mordants. As far as fastness properties concerned, natural mordants show good results on Milk Fabric. Rubbing, light and wash fastness properties rating stand moderate to excellent. It can be also concluded from the above found results that whole dyeing process can be done using renewable eco-friendly natural materials. Therefore there is a great scope for eco-friendly dyeing of Milk textile materials with Kalanchoe Pinnata. Natural dye from K.Pinnata can effectively be used for dyeing Milk fabric. The species of Kalanchoe pinnata has significant antibacterial effect against many airborne disease-causing grams negative and gram-positive bacteria and predominantly against bacteria that cause skin infection. Antimicrobial behavior of dye extract is excellent against both garm positive and gram negative bacteria and dyed fabric shows extensive application in medical textile

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