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Ecofriendly medical textile using *Morinda pubescens* J. E. smith as a source of natural dye

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Abstract
In recent days the inherent advantages of plant based dyes has resulted in the revival and usage in day to day life of human being. In the present study survey was carried out in dye yielding plant of south India and around 33 plants have been documented of them. The hot water extraction of the plant *Morinda pubescens* (Smith) was subjected for its dying ability and colour fastness in cotton fabric at different pH and the colour changes was absorbed from yellowish to deep reddish colour.
The spectral results at 279 nm and 470 nm showed two peak values with the presence of active compound quinone ring in the dye molecule. Addition of plant based mordant namely *Terminalia chebula* formed a dye complex that enhanced dye insoluble and complex that enhanced the dye insoluble reduced the fasting of colors in the fabric while assessing the colour measurement of the dye. Colour value of 1.9 yellow+10.9 red have been recorded in this study and the surface depth of the colour (K/S value) was ranging from 8.7 to 7.8 in without pH condition and 10.7 to 8.35 at a pH range of 8-10.The dyed fabric exhibited significant antibacterial activity against bacteria namely *Staphylococcus aureus* and fungi *Candida albicans*. Hence the plant based dye *M. pubescens* can be used to manufacture medical textiles.

Keywords: Ecofriendly medical textile, *Morinda pubescens,* dye yielding plant, *Terminalia chebula*

1. Introduction
Data Antimicrobial finishes using natural dyes has been the current vogue that promotes an ecofriendly life style. Natural dyes are environmental friendly, non -toxic, non-carcinogenic, non-allergic, renewable resources. Biosphere is being gifted with more than 500 plant species that yield natural dyes (Mahanta *et al* 2005) [11]. Many plant extracts exhibit the significant amount of antimicrobial properties which is used as textile finishing agents in the crude one or in microcapsules to enrich the durability and controlled release of the extracts (Thilagavathi 2007) [16].
Herbal textiles and dyes have great vista of applications in diverse field of human life. These dyes have been used for centuries to produce colors for fabrics, yarns, leather, food etc. Natural dyes exhibit better biodegradation and have a better compatibility with the environment. Application of the natural dyes has potential to earn carbon credit by consumption of fossil fuel based synthetic dye. Antimicrobial property or natural dye such as indigo, pomegranate, myrobalan, Indian madder of against bacteria like *Escherichia coli Klebsiella pneumoniae* have been reported (Gupta *et al*., 2004, Machado *et al*., 2008).
In the present study on antimicrobial textile finish using the bark of *Morinda Pubescence* (Linn) of Rubiaceae has been investigated since the plant has been reported to possess medicinal property besides its natural dye. Its leaves and fruits are used as antiseptic and antibacterial; the infusion of root bark is being used to head rounds burning sensation, Skin disease heals, etc.

2. Materials and methods
2.1 Extraction of dye stuff:
The wood of *Morinda pubescence* was collected from campus of Gandhigram Rural Institute. The sample was washed, chopped in to tiny pieces, dried and ground in to a fine

Powder of 1-5mm size using mechanical disintegrator. Known of the sample was subjected to extraction using hot water till the colour in the subsequent extracts became negligible. The extraction thus collected was homogenized, filtered, concentrated under reduced pressure and air dried. Colour measurement was determined using Lobi bond Tintometer (Model F, 12v, 20 watts OSRAM, 1^{-cm} cell) and spectral characteristics were assessed using UV-Visible spectrophotometer (Jasco V-630).The absorption peaks at different absorption (ie) 200-600nm were recorded using water as solvent for the preparation of the dye solution

2.2 Preparation of fabric

Cotton fabric procedure from KVIC sponsored khadi show room of Gandhi gram, Tamilnadu with plain weave and fabric content wrap; weft of 30; 20/inch respectively was used as substrate. It was washed in a solution containing 0.5g/l sodium carbonate and 2g/l non-ionic detergent solution at 50 ^{0}C for 25 minutes. The ratio maintained during scoured material thoroughly with deionized water which was then allowed to dry out completely at room temperature.

2.3 Mordenting

The scoured material was soaked in deionized water for 30 min and then mordanted with myrobalan *(Terminalia chebula)* powder was soaked in 1.25 l of deionized water for overnight at room temperature and 10% of filtrate was used as a premordant.

2.4 Dyeing

The premordant cotton fabric was immersed directly in dye bath containing 25g/l of dye and gently boiled for 45 min by maintaining the temperature 90 ^{0}C at pH 8. In order to get uniform dye, the fabric was stirred regularly. The dyed cotton fabric was taken out, rinsed in tap water and washed with soap nut solution at 40-50 ^{0}C for about 10 min. washing of the fabric was performed thoroughly with water and the fabric was shadow dried. The same process was carried out on pH 9, 10 and at different concentration such as 1g/40ml; 2g/40ml.

2.5 Measurement of color strength

The K/S values were determined using spectrometer using the Kubelka MUnk equation where R is the reflectance of the fabric at λ max; K is the absorption co efficient and S is the scattering co-efficient. The colorimetric information was then calculated using the formula.

$$\frac{[K]}{S}\lambda = \frac{(1-R\lambda)2}{2*R\lambda}$$

Software CIELAB used to study the dyeing property of *Morinda pubescens* and colour system was derived from the CIE tri-stimulus values of X, Y and Z.

2.6 Fastness test

The dyed fabric was tested for colour fastness. Colour fastness is usually rated either by loss of depth of colour in original samples or expressed by staining scale. In this study, the colour fasters to artificial light xenon are fading lamp test (AT CC-16(option 5):2004 10 AFU-Grey scale rating) was carried out. Wash fastness was carried out by washing the dyed fabric with non-ionic soap and commercial laundering (ISO 105-C 10:2006) with AIS test was carried out. Colour fastness to rubbing (IS 76:1988 Reaffirmed: 2004) was used for assessing change in shade and in staining (Wang fung and Hardcastle, 2001) [17].

2.7 Antibacterial finish of textile

The qualitative antibacterial effective ness of treated fabric by the *Morinda* dye was tested using standard method of AATCC 147.In the test, disc diffusion method was followed. Pathogenic strains of *Staphylococcus aureus* and *Candida albicans* were used. The zone of inhibition was evaluated.

3. Result

Yellowish to deep reddish colour was obtained from the crude extraction of the *Morinda pubescence* wood. The spectra showed two peaks at 279nm and 470 nm which denoted the characteristic of the quinine ring in the dye molecule. The specter indicated that the chemical nature of the dye remained unaffected after extraction. The colour measurement revealed the status of the dyes 1.9 yellow+10.9 red. The K/S value at different concentrations (1g/40ml &2g/40ml) and at pH of 8, 9 and 10 were recorded (Table1 and 2). Higher colour measurement in terms ΔE was recorded at pH 8 in 1g/40ml concentrations.

Table 1: Determination of surface depth of colour (K/S value)

	Parameters							
	Without pH		**pH variables**					
	-		**8**		**9**		**10**	
Concentrations	1g/40ml	2g/40ml	1g/40ml	2g/40ml	1g/40ml	2g/40ml	1g/40ml	2g/40ml
K/S	8.7234	7.8812	10.7002	11.0122	8.772	7.8144	8.6836	8.3555

Table 2: Measurement of colour/Spectral characteristics

Colour-co Ordination	**Dye concentration variables**		**pH variables**					
	Without pH control		8		9		10	
	1g/40 ml	2g/40 ml	1g/40 ml	2g/40 ml	1g/40 Ml	2g/40 ml	1g/40 ml	2g/40 ml
△ E*	11.084	14.061	13.522	14.319	12.815	14.004	11.655	12.050
△ L*	-2.566	-3.562	-3.328	-3.766	-3.256	-3.608	-3.017	-3.221
△ A*	9.343	10.558	10.558	10.278	9.744	10.268	8.794	8.721
△ B*	-5.383	-8.287	-7.766	-9.231	-7.660	-8.812	-7.029	-7.667
△ C*	-2.379	-3.632	-3.429	-4.647	-3.909	-4.370	-4.029	-4.577
△ H*	-10.517	-13.109	-12.650	-13.010	-11.762	-12.806	-10.512	-10.672

Comments: △ E*= colour strength, △ L*= Darker, △ A*= Red, △B*= yellow, △C*= Duller, △H*= colour hue.

Morinda play an important role in imparting colour to the fabric. Addition of mordant complexes the fiber and making it insoluble and thus reduce the fasting of colour. At pH 8 light fastness to colour was formed with 3-4 rating; washing fastness and rubbing fastness were found to be the rating of 4 in 2g/40ml (Table 3)

Fastness rating of the dyed cotton fabrics

SL. No	Parameters		Rubbing fastness		Washing Fastness	Light fastness
	pH	concentration	Wet	Dry		
1		Pre mordent (1g/40ml)	2-3	2-3	2-3	1
2		Pre mordent (2g/40ml)	2-3	2-3	2-3	1
3	8	(1g/40ml)	3-4	3	3-4	1-2
4	8	(2g/40ml)	4*	4*	4*	2-3*
5	9	(1g/40ml)	3-4	3-	3-4	1-2
6	9	(2g/40ml)	3-4	3	3-4	1-2
7	10	(1g/40ml)	3-4	3	3-4	1-2
8	10	(2g/40ml)	3-4	3	3-4	1-2

The presence study recorded the antimicrobial efficacy of dyed fabric. Zone of inhibition with and without pH adjustment were recorded. At pH 8, maximum of 12mm inhibition was found for *Staphylococcus aureus* and 10mm inhibition was recorded for *Candida albicans* and no zone formation was noticed in cotton fabric without dye.

4. Discussion

Natural dyes are colorant derived from occurring plants such as indigo and saffron (Chongaiah *et al*, 2012). They usually produce soft, lustrous and soothing shade to the human eyes. (Samantha *et al* 2009) [15]. Natural dyes from plant based materials are proven to be the important alteration to the use of synthetic dyes the textile industries and they work best with natural fibers (Gulrajana 1992) [3]. Plant such as *Bixa orellana* Linn (Bixaceae), I Linn (Zingiberaceae), *Lawsonia inermis* Linn (Lythracear)I (Rubiaceae) and *Rubia cordifolia* (Rubiaceae) were reported as common dye yielding plants in Uganda (Katende 1995) [8].

Success rate of any dye in the industry mainly lies on the colour intensity and colour strength. The increase of K/S value with increase in concentration of dye source indicated that dye treatment on fabric provided move dye sites than untreated fabric (Saravana *et al*.,2013) [14]. The results obtained in this study corroborate with the findings of Kanchana *et al*., 2013 [7] and Baishya *et al* 2012 [1]. reported that the dye from plant source such as *Clitoria ternatea, Tagetes erecta, Punica granatum Callistemon cirinus* at pH 6-8 showed increase in K/S value with decrease ΔE, ΔL, ΔA, ΔC and ΔH and they also reported that the above parameter were decrease in pH. The cotton fabric dyed with plant extract showed good wash fastness; rub fastness and light fastness for all the tested pH and dye concentration. The good light fastness is due to the formation of a complex with transition metal which protected the chromophoric group dissipate their energy by resonating within six member ring thus formed and hence protect the dye (Jothi 2008) [6]. In addition, the mordant complexes the fibre, making it insoluble and thus reduced the fasting of colour. Murugesan *et al* 2014 [10] reported that wide range of soft and light colors in cotton using the bark of *Citrifolia*

Wash fastness of the dye is influenced for the rete of diffusion of the dye and state of the dye inside the fibre. The mordant added cotton fabric showed higher wash and rub fastness than premordant fabrics as reported by Basishya *et al* 2012 [1]. And Murugasan 2014 [10]. Dye yielding plants also possessed medicinal value. Siva (2007) [13] reported that natural dye from turmeric produce yellow colour and they also act as a powerful antiseptic that can revitalize the skin while indigo gives a cooling sensation. Naphthoquinones reported from henna dye *(Lawsonia inermis)* have antifungal and antimicrobial activity (Siva 2007) [13]. In the presence study, Morinda extract dyed fabric incorporating terminally as a mordant recorded antimicrobial activity. It Might be due to their medicinal property owing the presence of phenols, tannins, quinines, flavonoids. Gularajanic 2001 [4] recommended the usage of natural dyes as they are biodegradable, non-carcinogenic, on mutagenic produce colour that smoother the human eyes and sometimes act as health cure. Geissler (2006) [5] and Massey *et al* 2008 [9]. have reported the use of herbal cloths in Ayurveda health clinical for the treatment of broad range of disease like skin infection, eczema, Psoriasis etc.

The present study unveiled the *Morinda* wood has the dyeing potential as a source for cotton dying. The use of mordant namely *Terminalia* species on the other hand resulted in good fastness exhibited by the cotton fabric. The coating of cotton fabric using these plant natural products was found to exhibit antimicrobial properties. These results indicate that this technique may be used in the textile industry, as antibacterial finish of medical cloths is being appreciated and also there is an increasing demand on global scale.

5. Reference

1. Baishya D, Talukdar J, Sandhya S. Cotton dying with Natural dye extracted from Flower of Bottle brush (*Callistemon citrinus*). Universal journal of Environmental research and Technology. 2012; 2(5):377-382.
2. Chengaiah B, Malliarjuna Rao KK, Mahesh Kumar K, Alagusundaram A, Madhusudhanana chetty C. Medicinal importance of natural dyes: A review. International journal of pharma tech research. 2010; (2):144-154.
3. Gupta Gulrajani M L, Agarwal, Jain M. Application of natural dyes on bleeched coir yarn, Indian textile journal. 1992; (102):78.
4. Gulrajani ML. Present study on Natural dyes, Indian Journal of fiber and textile research. 2001; (26):191-201.
5. Geissler S. Extraction of natural dyes for dyeing from coloured plant wastes released from the food and beverage industry. J Sc. Food Agric. 2006; 86:233-242.
6. Jothi D. Extraction of natural dyes from Africal marigold flower (Tagets errecta) for Textilr coloration, AUTEX journal. 2008; 8(2):49-53.

7. Kanchana R, Apurva Fernands, Bhargavi Bha, Surabi budkule, Santeshwari Dessai, Reshma Mohan. Dyeing of Textile with Natural Dyes-An Eco friendly Approach, International journal of chem tech research. 2013; 5(5):2102-2109.
8. Katende AB. Useful Trees and Shrubs for Uganda. Identification, Propagation and Management for Agricultural and Pastoral Communities. Techncal Handbook, Kenya, Nairobi. 1995; 41:683.
9. Massey D, Geol P, Swerev M. Antimicrobial finishes and Modificatio. Melli and Intl. 2008, 151.
10. Murugesan S, Ramesh S, Seerangarajan R. Natural dye extraction using spray dry method from the root bark of the *Morinda citrifolia* and its characteristics on silk fabric. A value chain in Natural dyes, International workshop on natural dyes, BS Publications Hyderabad. 2014; (1):186-190.
11. Mahanta D, Tiwari SC. Natural dye yielding plants and indigenous knowledge on dye preparation in Arunachal Pradesh, North East India, Current sciences. 2005; (88):1474-1480.
12. Machado TB, Pinto AV. Antimicrobial activity of selected plants for medical textiles, International journal of Antimicrobial agents. 2003; 21(3):279-284.
13. Siva R. Status of Natural Dyes and dye –yielding plats in India, Current Sciences. 2007; 92(7):916-925.
14. Saravanan P, Chandramohan G, Saivaraj S, Deepa D. Extraction and application of Eco-friendly dye obtaining from bark of *Odina wodier* L. on cotton fabric. Journal of Natural and Plant Resource. 2013; (2):80-85.
15. Samantha AK, Agarwal P. Application of natural dyes on Textiles, Indian journal of Fibre and Textile research. 2009; (34):384-399.
16. Thilagavathi G, Krishna Bala S. Microencapsulation of herbal extracts for microbial resistance in healthcare textile, Indian J Fib Tex Res. 2007; (32):351-354.
17. Walter fung and Hardcastle Textile in Automotive Engineering, 2001.