BOOK OF ABSTRACTS

National Workshop and Seminar

on

Vegetable dye and its application on textiles

2nd – 4th December, 2011

Organised by

DEPARTMENT OF SILPA-SADANA

VISVA-BHARATI

Srinik.r Tc0.1 0 0 2-9 j/T(2(0012 265.26 263.94 Tm0Tr-.0 Tc.0 Tw4DANA)

- -

Organising Committee

Chief Advisor(s)
Sri Shantanu Kumar Jena
Sri Arup Mukherjee

Convener
Dr Sankar Roy Maulik

Programme Director
Sri Prabir Kumar Choudhuri

Editor (s)
Sri Ashis Mitra
Dr. Arabinda Mondal

Publicity & Promotion
Sri Mrinal Kanti Sarkar

From the Organisers' Desk …….

Silpa-Sadana is the pioneer Institution under the aegis of Visva-Bharati, a central university, for imparting technical education in the domain of cottage and small scale industries since its inception in 1922. The great poet and philosopher "Gurudeva" Rabindranath Tagore, founder of Visva-Bharati, had the dream of rejuvenating the traditional knowledge and to flourish it with a view to socio-economic upliftment of rural people. Craft sectors had been given the top most priority. Later the great son of the great poet, Rathindranath devoted his entire life to turn his father's dream into reality through his indefatigable and enervated efforts. To fulfil this mission, of course, he was backed by the active assistance from his wife, Pratimadevi, who stretched her arms in this noble venture. Through their continuous research and endevour, Silpa-Sadana, in due course, became the Cottage Industries Training Centre and the produce from its extension wing emerged out as the trend setter in design throughout the country.

It is a great pleasure and pride on our part

Continue

Seminar Papers

Silpa-Sadana ——— past and present

Raj Kumar Konar
Silpa-Sadana, Palli Samgathan Vibhaga, Visva-Bharati,
Sriniketan, Birbhum, West Bengal -731 236.

Introduction

The department of Silpa-Sadana (erstwhile Shilpa Bhavana) has been playing a pivotal role to carry forward the dream of Gurudeva Rabindranath Tagore of acquiring the economic self-sufficiency to the underprivileged rural community of India for decades. Rathindranath Tagore has given the shape of Gurudeva's vision through establishing Cottage Industries training Centre (now popularly known as Silpa-Sadana). It is the craft wing of Visva-Bharati and one of the oldest Technical Institution of India. Silpa-Sadana has a long tradition in the production of innovative & artistic handloom and handcrafted products and, hence is well known for its Technical training and exquisite craft based products in cottage industries & craft since its inception. It was set-up in 1922 as an integral part of Gurudeva's Sriniketan experiment of rural reconstruction.

Why Silpa-Sadana was formed? ——— the idea behind and its contribution

Its mission was:

To revive & revitalize the dying craft sector through cultural reawakening.

To develop craft as an industry and alternative mode of livelihood in the villages.

To turn out functional products with artistic & cultural sensibilities for the local and export market.

To impart the required technical training for creating appropriate opportunities and achieve economic self-sufficiency for craftsmen in the villages.

It had taken a leadership role in reviving and revitalizing the rural industries and craft sector, in particular, for sustainable economic regeneration of the villages. It occupies a unique position among the technical institutions in having been able to revitalize the decadent cottage industries by those artistic and creative impul

- -

New campus

Silpa-Sadana is one of the oldest institutes of Visva-Bharati, a central university. Most of its infrastructural facilities are backdated. Planning to update these has been done. In the 11th Five-year Plan period about rupees twelve cores has been allotted to Silpa-Sadana for building a new campus including studios & workshops. The construction work is in full swing. That is why the department is facing some difficulties in carrying out its activities in this stopgap period.

Activities

Presently Silpa-Sadana has three broad divisions: i) Technical training, ii) Production and Extension to offer necessary assistance to the trainees, trained personnel and skilled craftsmen from the adjoining villages to produce craft articles on behalf of the department on contractual basis, and iii) Marketing Wing to sell its produce. The products made are sold mostly through its only Sales Emporium located at its Sriniketan premises and also through its annual sales counter put up at " Poush-Mei

Coom . 1 f r

- -

Training Programme	Intake capacity (in Total)
A. Bachelor in Design (B. Des.) with specialization in: i) Pottery-Ceramics & Lifestyle Products ii) Furniture & Lifestyle Products iii) Textile & Accessories	36
B. Certificate courses: in i) Wood Work, ii) Handloom Weaving, iii) Pottery-Ceramics, iv) Artistic Leather Craft, v) Batik Work, vi) Handmade Paper Making	54
C. Short Term Programmes in Indian Craft Techniques	Need based

Rathindranath Tagore and his contribution towards rural socio-economic development

Saswati Pal Choudhuri (Mandal)
Department of Museology, University of Calcutta

Abstract

Rathindranath Tagore was the most representative product of Rabindranath's educational ideal. He had the various intellectual outputs on the different fields. The paper explores the intellectuality of Rathindranath Tagore from the various points of view. He was an ideal teacher, scientist, social reformer, a good administrator and an artist as well. He remains within us as a natural lover also. In this paper, the author also highlighted the contribution of Rathindranath Tagore towards socio-economic development at Sriniketan.

***Keywords*:** Batik,

role to promote Sriniketan. During Java and Bali visit of Rabindranath Tagore, Surendranath Kar accompanied him and he studied batik work on textile in details by using different tools and equipments. In 1927 he and Rathindranath imported few tools and equipments (Tjantings), and at Sriniketan and Kala-Bhavana they introduced batik handicraft which was very easy and more applicable for rural sectors with the help of Nandalal Bose and the students of Kala-Bhavana [3]. During that time, there was no skilled weaver at Sriniketan locality to produce quality textile. However, only a few non professional Mohammedans at Sriniketan area used to produce very course and inferior variety of textiles. To solve those problems Rathindranath employed a person from Serampore to teach modern techniques of weaving that helped enhance the textile cottage industry at Sriniketan [1, 3]. During his medical treatment in England in the year 1928, he was impressed on the batik work on textile and leather. After that he and his wife Smt. Pratima Devi made an in-depth study on leather batik and imported all the vital tools, equipments and colours. Rathindranath and his wife established a school at Patiswar with the financial support of 'general fund' that he created earlier to educate the poor villagers thereby making them financially self sufficient, and later on at Sriniketan the same model/idea had also been implemented. Rathindranath also sent Smt. Pratima Devi to Paris to learn batik work so that the product quality of Silpa-Sadana and Kala-Bhavana improves further [3]**.**

As an artist

As a painter, he created different kinds of paintings i.e. flower study and landscapes. His flower study was about expressions of scientific mind, but application of colour and style was like original. Rathindranath, generally, did not mention any date in his painting except a very few. His oldest painting was in the year 1928. We can find the style and elements of Impressionism Art in the paintings of Rathindranath. During this time Abanindranath started the movement of Indian traditional style of painting. But in case of landscapes and wooden inlays, Rathindranath was influenced by his father. There are only 52 paintings of Rathindranath in the collection of Rabindra-Bhavana. His others paintings remain scattered among the Rabindra Bharati Society, Rabindra Bharati University and in other private collections. His artistic sense and aesthetics not only helped him design wooden inlays, ceramics materials, and textile prints etc. at Sriniketan but also influenced to set up small scale industries in the rural areas. The planning of Uttarayan Garden, Pampa lake and different buildings like Udayana, Chitrabhanu, Guhaghar, creation of wooden furniture and crafts etc. are the examples of his artistic expression. He imported different tools and equipments to create enormous wood crafts, wood inlays etc. The modern craft artists followed him to create exclusive art objects. Stela Cramrish rightly says "*Rathindranath Tagore is a maker of form. To the art of India of today he gives back the dignity of its craft out of the store house of his mine he shapes the order of things and their fitness. He carves objects from many woods and paints the portrait the many flowers. His works does not belong to any school. Self-taught and straight forward it follows the disciplines of first principle and applies there with tenderness of precession to small objects and pictures"* [4].

References

1. 'Tagore *Rahthindranath, Janma Satabarsa Purti–Sadergha'*, Visva-Bharati Granthana Bivaga, Kolkata, 1988.
2. *Tagore Rathindranath,* 'On the Edges of Time', Visva-Bharati Granthana Bivaga, Kolkata (1958).
3. *Tagore Rathindranath, 'Pitri Smriti'*. Kolkata:Jigasa.(In Bengali), (1973).
4. *Kramrish, Stella*, 'Introduction' Tagore. New Delhi: All India Fine Arts and Craft Society, (1948).
5. *Mandal, P. K*, "*Rabindra-Bhavana Sangrahasala, Santiniketan"*, (Bengali). Journal of the Dept. of Museology, University of Calcutta, Vol. 4, (2005),
6. *Mandal, P.K*, "Patachitra in Bengal: An Intangible Heritage", Journal of Museums Association of India, 24 (2004).
7. Visva-Bharati Bulletin, No. 32, January, 1951.

Acknowledgement

Author wishes to acknowledge Sri P.K. Mandal, Rabindra-Bhavana, and Sri Tapas Kumar Das, Central library, Visva-Bharati. Last but not the least, the author also acknowledges Smt. Susmita Roy Maulik- for her inspiration assistance while writing this article.

Innovative dyeing and printing with natural dyes

Arup Mukherjee
Visva-Bharati University, Department of Silpa-Sadana, Textile Section,
Sriniketan, Birbhum, West Bengal-731 236.

Abstract

The whole world is deeply concerned about global warming which may cause severe disaster in due course if proper precautionary measure is not taken right now. Global warming is due to increase of Green House Gases (GHG) produced mainly from power plants, big industries, auto vehicles, small and cottage industries and even domestic activities where fuels like coal, diesel, petrol and wood are used regularly. Deforestation is another reason of global warming as trees and plants are the consumers of carbon dioxide evolved from different fuels. 'Carbon Foot Print' is the total set of Green House Gases consisting of chlorofluorocarbon, methane and nitrogen oxide apart from carbon dioxide which remains in the highest percentage and is responsible for maintaining the atmospheric temperature. Foreign textile buyers are now emphasizing on carbon foot print especially on natural color products that deserve to be really eco-friendly as well as environ-friendly. The small work done here aims this noble vision to encourage other industries of different sectors to keep an eye to their products which should not affect the Green House Effect (GHE).

***Keywords*:** Carbon foot print, Global warming, Green house gases, Green house effect.

Introduction

Use of natural dyes on Textile material has become very much popular throughout the world due to its eco-friendliness, environ-friendlinesndl1[(phasizi 1 Tf)58-5.5(fue4754gs l.2(sphhouenor6.)o1

Conventional method for dyeing and printing

The conventional process has been performed with a liquor ratio of 1:20 for cotton and 1:50 for silk to get suitable working conditions for each of the materials. Other conditions like dyeing time and temperature are kept same.

After preparatory process, material weight is taken 20gm for both cotton and silk. Other

- -

the following recipes. The lake formation is done with two different salts separately with one dye.

Recipe 1

For 200ml padding liquor: -
Lac / Terbula – 100gm/lt - 20gm
Ferrous sT]TJT*.0007 T F4rous sT]TJT*.u9 0 x1(g)1.1.6(ion)]TJ/TT1 1 of3.8867 0 TD0 T01 Tm-.005 TclS

Beaker Dyeing machine of EEC, Mumbai. Wet a

i. Fastness results of the dyed shades are almost equal in both the processes. In conventional process, scope of printing is limited, rather lengthy and very tuff. It is a common practice in the craft sectors that Fabrics are first treated either with metal salt or with dye and then printed with vice-verse to get the color designs. It

- -

Environmental compliance for textile dye effluent with special reference to vegetable dyes

Dipankar Adhya
Textile Technologist & Environmental Consultant,
Mob: +91 9433011902

Abstract

All the “naturals” are not safe or environment friendly. The Natural/ vegetable dye effluent also need to be treated to comply with environmental statutory regulations by Pollution Control Board. Since the advantage with vegetable dye effluent is it’s low BOD: COD ratio, the designing of effluent treatment process and effluent treatment plant (ETP) for vegetable dye effluent is much simpler compared to that for synthetic dyes. With simplified explanation of environmental statutory compliance parameters like BOD, COD, TSS, pH, temperature etc. and its effects, designing of ETP and prospect of environmental compliance have been made more users friendly in this paper.

***Keywords*:** Activated carbon, Activated sludge, Aeration, Adsorption, BOD, Clarifier, COD, Filtration, Natural dyes, Wood charcoal.

Reference

1. N. Manivasakam : Industrial Effluents – Origin Characteristic, effects analysis & Treatment . 1997
2. P.M.Chan , C.W.M. Yuen and K.W.Yeung : The effect of Natural Dye Effluent on Environment. RJTA , Vol 6, No 1
3. Natural Dyes – O ECOTEXTILES
4. Dr. Subrata Das : Textile Effluent Treatment – A case Study in Home Textile Zone.
5. Jaya Paul A /L Arumai Dhas : Removal of

oil and then washed. Printing is done on wooden table, the size of which depends on the length of to be printed (18 foot approx.). These tables have a layer of ply on which there are 20 layers of tart and a sheet of cloth on which comes the final fabric.

Direct Dye Printing

In the first process, the dye solutions are poured in the tray. The printer presses the block into the dye tray and then onto the cloth until the pattern is complete. For every imprint the block is pressed into the tray to get a fresh smear of paste. The outline pattern is done in blocks for the background and highlights in different colors. Once each pattern is complete, the cloth is ready for the dye vat. This printing is primarily done by male printers.

Resist Printing

Bagru is known for its mastery in the second type, a special printing technique of Resist style called '*Dabu'* printing. Its essence lies in printing with specially prepared *Dabu* paste i.e. applying thick black mud paste onto the fabric and then dyeing the fabrics. The prepared cloth is printed with *Dabu* paste by wooden blocks. Thereafter the printed cloth is dyed with natural colour, these results in resisting dyeing in the portions which were hidden and a printed effect is created in the fabrics. Each family follows its own secret of making *Dabu* paste. Although, women have traditionally done the dabu printing, men are also involving themselves in it.

Dabu preparation

In general Dabu is made by mixing:

(a) Lime dissolved in water,

(b) Natural gum '*Bedhan'*

- -

Preparation of Dye solution

Dyeing process varies depending on the colour

Conclusions

Today, artisans of various regions are using modern techniques to develop their craft. While traditional art form is replaced by modern tools, techniques and synthetic dyes, many *Chhippas* have given up the art of hand block printing. Yet there are a handful of artisans who engross themselves in their traditional and distinct art of dyeing and printing. As the world is waking up to environmental consciousness and eco-friendliness, this captivating and exotic art is getting recognized day by day.

Reference:

1. Hipparagi S A, Sinha R K, Somashekar T H & Radhalakshmi Y C, Traditional Textiles printing in India, *Indian Silk, March 2007,* pp 4.
2. Census of India 2001, *Census Commission of India*.
3. Ramesha M N, Bagru- Enchanting prints from the Desert, *Indian Silk, March 200,* pp 36.
4. Mahajan S, Contemporisation of Bagru printing, www.fibre2 fashion.com

Different types of motifs used in *Bagru* printing:

The significant motifs of Bagru prints are:

(i) Aath Kaliyan	*(ii) Bankadi*
(iii) Bada Bunta	*(iv)Hajura*
(v) Bewada	*(vi)Hara Dhania*
(vii) Kamal	*(viii) Chopad*
(ix) Kel	*(x) Pyala*
(xi) Chhota Bel	

New age marketing concept of Indian textile products

Sanjay Mukhopadhyay
Crystal Martin (Knitwear) Limited, Nottinghamshire, UK,
Work Station – Kolkata, India
sanjay.mukherjee@uk.crystal-martin.com

Abstract

Textile becomes key value driver for Indian GDP growth and it is one of the major contributors of India's export earnings. Export is essential for Indian economy to reduce the trade deficit (difference of earnings in import and export) despite of India's growing domestic. Some of the key commodities like petroleum products are required to be imported and those are now become major reason for negative cash flow in Import account. Textile is not a high value items so despite of huge quantity export, the contribution in monitory terms are not so great. Needless to mention that Indian Spinners have to place themselves as a leader in value added textiles and other textile products which are at the upper tier in the value chain. It doesn't mean that we would ignore or remove the attention for supplying traditional/already established textile items in overseas. In this paper, the author has highlighted one of the most contemporary approaches ——— **relationship marketing** to accomplish this goal, which is a combination of many complementary and supplementary marketing functions, organization's structure, ethos and philosophy of the management towards the business. Relationship marketing is the total marketing where customer is in focus, contrary to the early age business philosophy where product and production was considered as focal area. Most significantly, in relationship marketing, the all support functions have to be synchronised to deliver uninterrupted and smooth output to deliver the best possible customer satisfaction. Customer orientation, retention and satisfaction are the key result driver for relationship marketing. Where as, to design effective result oriented full proof system, there is no substitute for being leaders in all of the 7p's (product, price, place, promotion, physical distribution, positioning and people) in the contemporary marketing functions. In relationship marketing, long term strategy is a key thing for the survival and sustainability of the organisation so the key leaders in the marketing team have to have the ability to do the internal marketing. Internal marketing is the concept of supplier/customer relationship in all supportive functions in the organisation so in a sense everyone in the organisation is the part of marketing team and having one goal to achieve ultimate customer satisfaction. According to the author, the best thing in relationship marketing is Customer Retention, so the late implementers of this concept would have to try more to get the new customer from their competitor's fold.

Keywords**:** Contemporary approaches, Customer retention, Export, GDP, Import, Relationship marketing, 7p's.

Introduction

The textiles industry in India enjoys a distinctive position due to the pivotal role it plays by way of contribution to industrial output, employment generation (second largest after agriculture) and export earnings of the country. The industry is rich and varied, embracing

The share of textile exports in total exports was 11.29 per cent during April-December 2010 as against 12.34 per cent during April- December 2009.

So in a nutshell Textiles is an important activity for India's growth point of view.

Growth is measured in terms of money especially in market economy where the whole globe is a market for everyone and every one wants to be the leader in various segments of products and services.

If we go see the Maslow's need hierarchy model, the Textile is coming under Physiological need and that would be the need of every human being of the globe. In extremely diverse society of Globe there are multi segments of textile products and despite of catering huge domestic need, for India it is essential to reach all possible segments of textiles of overseas market.

So, till now what Indian exporters are doing largely?

Textile is age old Industry of all oldest civilization like India, China, Middle east, Latin America etc. But in true sense, Textiles products started being market Globally when Industrial revolution had occurred in between 18^{th} to 19^{th} century in Europe and by the power of colonial rule mostly British traders and businessman was the first who started dumping power loom fabrics in Indian market. Before Muslim rule Indians didn't know to wear stitched fabric and the cloth / fabric used to manufacture in hand spinning (*Charkha*) and hand loom (*Tant*) by Weavers'

So, it is quite evident that selling of yarn would be much profitable than selling of fibre; similarly selling of fabric would create more value than that of yarn and needless to mention garment selling should give much return than selling of fibre, Yarn and fabric.

Now, question comes if profit maximization can be achieved by selling the product in highest value chain i.e. garment then why all are not concentrating on selling such thing.

Before answering this question let me mention the total segment of garment textiles where small unorganised tailors to big quantity selling retails, high end organised brand both local and global, high end and medium end boutique, big unorganised basic garment sellers – everyone is there. Profit margin varies in different segments and with the economies of scale.

Suppose one up market retail is selling one garment with profit margin 20% whereas the same product is available in mass market retail with lower price so certainly mass market retailers are not getting same % of profit but due to maximising qty. they could able to generate more value from the same business.

Let me back to the general marketing concept of Textile marketing – Traditional method and contemporary style.

Textile product marketing can be broadly divided into two parts –

B2B and B2C

B2B is – fibre, yarn, fabric and even garment marketing / selling which is also termed as Industrial selling.

Fibre manufacturer will sell their product to Spinner.

Then Spinner will sell the yarn (manufactured from the fibre) to the fabric manufacturer or knitter.

Knitter will then send to garment manufacturer and garment will move from them to Retailer.

So in B to B chain all people are buying textiles for business means adding some value before it moves to next value chain.

B2C

When you or I are buying some product form the market then the transaction / business is called B to C.

In textile business garment or final products like carpet, throws, home furnishing fabrics, hand knitting yarns are direct consumer items where one or more business house are selling / targeting individual customer.

Traditional method of Textile marketing

Economy of scale: Maximizing the capacity to achieve lowest possible per unit cost.
Try to achieve monopoly: Focus only on finishing the competition by all possible way.
Standardisation in manufacturing to achieve cost effective product: To avoid the changes in manufacturing as minimum as possible and manufacturing same product day in day out to maximize efficiency to bring down the cost of production.

Using various channels of marketing like retailers / dealers / exclusive outlets or shops: Selling strategy by developing external marketing channel like agents, dealers, exclusive retailers to reduce the fixed marketing cost and minimize the cost of customer development.
Marketing personnel are concentrating on transaction rather than developing relationship with customers: Follow the strategy more transaction and more sales so efficient transaction experts considered as best marketing personnel who can only creates the sales volume in short term a

True implementation of customer servicing – on time in full (OTIF), proactive customer feed back system and design remedy short term as well as long term.
Frequent one to one meeting with customer by company representative and try to add value keeping customer need in focus.
Time to time send updated information to customer which are related to their

- $\hat{H}$

strategy is entirely independent to the cost of the product. In general, price is market driven and market is again dynamic domain which expands or contracts by the influence of demand and supply. And demand, supply and market behaviour are interlinked with each other.

Place – To select place where to sell the product. For monopoly situation, seller has enough choices to decide the place it is sell but competitive situation where there is no room for the seller to move as per their own choices.

Promotion– Advertisement and promotion is a key tool to reach the customer, to educate and lure them to go for that. It is playing with present need, potential need and hidden need of the customer and repeat and regular promotional activity are helping the product to stay in the market for long. In large selling consumable item this activity is leading towards Brand building exercise especially for B2C marketing. Promotion or advertisement is required by the B2B selling but their media is different than that of B2B.

Physical Distribution should be managed highest level of efficiency to achieve on time full delivery as per commitment.

Positioning – Same quality (basic ingredients are similar) garment can be sold in 200 buck as well 5000 buck depending how would it be pos a Tc-tiouepete pis entirelygV63>Tj/TTi.0 dll 500TTibe t

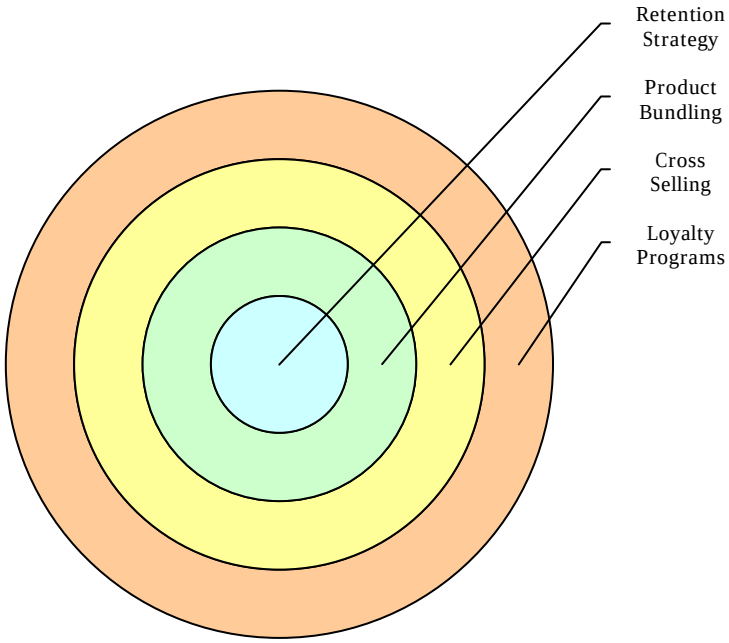
Contemporary approaches

Recent approaches in marketing include relationship marketing with focus on the customer, business marketing or industrial marketing with focus on an organization or institution and

marketing and communication activities on concrete marketing sequences that could run in autopilot, (also known as marketing sequences). The overall goals are to find, attract and win new clients, nurture and retain those the company already has, entice former clients back into the fold, and reduce the costs of marketing and client service. Once simply a label for a category of software tools, today, it generally denotes a company-wide business strategy embracing all client-facing departments and even beyond. When an implementation is effective, people, processes, and technology work in synergy to increase profitability, and reduce operational costs.

Satisfaction

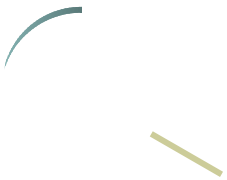
Relationship marketing relies upon the communication and acquisition of consumer requirements solely from existing customers in a mutually beneficial exchange usually involving permission for contact by the customer through an "opt-in" system. With particular relevance to customer satisfaction the relative price and quality of goods and services produced or sold through a company alongside customer service generally determine the amount of sales relative to that of competing companies. Although groups targeted through relationship marketing may be large, accuracy of communication and overall relevancy to the customer remains higher than that of direct marketing, but has less potential for generating new leads than direct marketing and is limited to Viral marketing for the acquisition of further customers.



Retention

A key principle of relationship marketing is the retention of customers through varying means and practices to ensure repeated trade from preexisting customers by satisfying requirements above those of competing companies through a mutually beneficial relationship.

Advantage of customer retention –



Use of natural dyes for antimicrobial finish

K.N. Das & G. Bhattacharya
Department of Textile Engineering, College of Engineering and Technology,
Biju Patnaik University of Technology, Bhubaneswar-751003, Orissa.

Abstract

The synthetic dyes and finishing chemicals are employed to the natural and synthetic fibre-fabrics for getting different functional properties, which are not that much eco-friendly and biodegradable in nature. The 'Green' technological concept has revolutionized the textile and fashion world by changing the idea of the new generation to use natural products and materials in their daily life style. In the horizon of Green Technology, natural antimicrobial dyes have played a vital role to dye natural fibres for developing natural antibacterial and colouring effects simultaneously. In the present work, few selected antimicrobial natural dyes were successfully applied (keeping dye concentration 20%) on mordanted cotton fabrics and a moderate to good washing and antimicrobial properties were obtained in the final products.

Keywords: Antimicrobial, Biodegradable, Eco-friendly, Natural products, Green Technology.

Introduction

The growtTJ-21.6503 -J-od wa7ogy.

Shigellaflexneri(SF)
Bacillusubtilis(BS)
Escherichia colli (E.colli)
The results are given in Table-2

Dyeing process

Two methods have been adopted for dyeing the co

showed resistance to three microbes Shigellaflexneri, Bacillusubtilis and Escherichia colli. But both the dyes exhibit poor zone of inhibition as seen from Fig. 1. Since the dyes extracted from the above plant species showed good antimicrobial activity against selected microbes, it was thought worthwhile to study their antimicrobial activity on application of such dyes on textile materials. The cotton fabric samples dyed with each dye extraction were tested for their antimicrobial activity against same microbes. The results show that there is a reduction in size of inhibition zone after dyeing (both in pre-mordanting and post-mordanting method of dyeing) in comparison to that of dyeing solution [Table 3-4]. Further, a drastic reduction in size of inhibition zone is observed in case of all dyed samples after washing. It indicates less potency of antimicrobial activity of such dyes after application on textile materials. This might be due to poor uptake of dyes molecule in the fabric. The durability of the antibacterial activity of the dyes in the fabric samples seem to be unstable after washing, as the rating of colour fastness to washing is mostly in the range of 2-3 [Table -5].

Table 2: Zone of Inhibition for Natural Dyes Against Selected Microbes Tested at 20% Concentration of Dye

	Zone Of Inhibition for Natural Dyes Against Selected Microbes(diameter in mm)			
Different Dyes (20%)	Staphylococcus aureus (SA)	Shigellaflexneri (SF)	Bacillusubtilis (BS)	Escherichia colli (E. Coli)
Chawalkodi	21	26	25	24
Rathanjyoti	-	-	15	14
Teak green leave	17	18	16	18
Banana dry leave	-	15	16	12
Mango dry wood powder	22	22	24	19
Marigold flower	22	20	20	15
Acasia Skin	18	21	18	20

- -

Fig. 1: (Y-axis -Zone of inhibition in mm and X-axis-Name of Natural dyes)

Table 3: AGAR test of dyed fabric (pre-mordanting) before and after washing fastness testing

Strains	Without washing Diameter of zone of inhibition in mm							After washing fastness testing Diameter of zone of inhibition in mm						
	CK	RJ	TGL	BDL	MDW	MF	AS	CK	RJ	TGL	BDL	MDW	MF	AS
SA	19	-	16	-	22	21	16	09	-	-	-	06	11	05
SF	22	-	18	16.	18	19	20	08	-	04	-	08	09	10
BS	22	15	16	12	22	20	18	07	-	06	-	05	10	08
E.Coli	21	12	17	14	18	18	19	05	-	-	-	04	08	05

CK-Chawalkodi , TGL-Teak green leave , MDW-Mango dry wood powder, MF-Marigold flower, AS-Acasia skin, RJ-Rathanjyoti, BDL-Banana dry leave.

- -

Table 4: AGAR test of dyed fabric (post mordanting) before and after Washing

CK-Chawalkodi, TGL-Teak green leave, MDW-Mango dry wood powder, MF-Marigold flower, AS-Acasia skin, RJ-Rathanjyoti, BDL-Banana dry leave.

References

1. Ramachandran, T., & et al (2004), Antimicrobial Textiles – an Overview, *IE (I) Journal – TX*, 84, 42-47.
2. Lim S H & Hudson S M , J Micromol Sci , Polymer Rev C43(2003) 223
3. Joshi M, Wazed Ali S &etal, Ecofriendly antimicrobial finishing of textiles using bioactive agents based on natural products. *Indian Journal of Fibre & Textile Research.* 2009; 34:295-304.
4. Aranaz I, Mengibar M, Harris R, Panos I, Mirralles B, Acosta N, Galed G and Heras A.

Demystifying the nature of spider silk and application of natural dye

Chandan Das
Starling Silk Mills Private Limited, Baranagar, Jalalpur, Malda, West Bengal
E-mail: starlingsilk@gmail.com, (M) 09434046455/09531599498

Abstract

Spider threads consist of long polymeric chains of protein molecules. These silk proteins are stored in the silk gland in a highly concentrated form until they are needed. The long chains with their repeating sequences of protein molecules are initially disoriented. Only in the spinning process the threads are oriented parallel to each other and form micro crystallites. Prof. Horst Kessler and his colleagues discovered that the individual spider silk proteins are first stored in the silk gland in small drops, called micelles.

Natural dyed spun silk carpets are very popular in U.S.A., Middle East and European market. Exclusive spun silk fabric produced from mulberry, tussar and muga pierced cocoons dyed with natural colours are very much popular in the export market.

***Keywords*:** Muga, Mulberry, Spider silk, Spun silk, Tussar.

- -

Dyeing of silk fabric with onion peel waste using unconventional methods

Deepali Singhee[1], Yamini Dhanania[2] & A K Samanta[3]

1 J.D. Birla Institute, Kolkata, West Bengal.
2 J D Birla Institute, Kokata, West Bengal.
3 Department of Fibre and Jute Technology, University of Calcutta, Institute of Jute Technology, Kolkata, WB.

Abstract

The present study is an endeavor to make the process of dyeing with natural dyes cost effective through use of a waste product that is available in plenty, and through use of room temperature in the dyeing process. Attempt has also been made to improve the light and wash fastness of silk fabric dyed with onion peel extract. The effect of varying conditions of extraction and dyeing process variables (time, temperature, *p*H, MLR and dye concentration) on the surface colour strength on the related colour parameters and colour fastness of the dyed fabric has been assessed and optimum value established. Dyeing process variables like *p*H, temperature and dye concentration show a wide dispersion of CDI values indicating that these are the predominating dyeing parameters for dyeing silk fabric with onion peel. Also, darker shades of ochre were produced when dyeing was carried out under acidic *p*H. Increase in MLR and dye concentration intensified the tone of the colour. There is ½ - 1 grade improvement in the light fastness of silk fabric dyed with aqueous extract of the onion peel and subsequently treated with 2% UV-absorbers (benztriazole, benzophenone and MEK) by the pad-dry method. Also, 2% dye fixing agents agents (Tinifix WS Conc., cetrimide and CTAB) show some improvement in wash fastness of dyed silk when applied by the pad-dry process. Further with an objective to economize on the water consumption and use of fuel/energy, silk fabric has also been dyed with purified onion peel extract by the simpler dyeing process pad-dry-cure and pad-batch-dry. Pad-batch-dry method gives highest *K/S* values, and uniform dyeing results when 5 gpl dye concentration of the purified onion peel extract is used on silk fabric.

***Keywords*:**

Direct application of natural dyes on garments

Tapas Bhattacharya
&
Ruhee Das Chowdhury
National Institute of Fashion Technology, Kolkata, West Bengal.

Abstract

With the world chanting the mantra of sustainability and going 'Green' for the health of the earth and its environment, fashion world is no alien to it. Fashion designers, manufacturers and retailers are busy developing 'green' ranges for people. Eco friendly natural dyed garments have scorched the ramps as fashion designers have rediscovered the beauty in natural dyes. However, the mass-market clothes are yet to get touched by natural dyes. The retailers are yet to display and sell natural dyed ranges in their stores. The manufacturers, in spite of seeing the hi-fashion natural dyed garments are restricted to use natural dyes in production due to some limitations. These limitations being, inconsistent colors shade by the lots of textiles. This paper explores the possibility of direct garment dyeing using natural dyes to avoid shade variation problems in mass production.

***Keywords*:** Environment, Fashion designer, Garment, Natural dyed.

Availability of resources for natural dye

Important dye yielding plants in respect of availability in reasonable quantity in India has recently been reviewed and reported in the literature[13]. Tea (*Camellia sinensis*) is found to be of practical commercial significance in view of wide availability of waste tea leaf and potential of colouring components of tea to colour silk, wool and cotton with acceptable colour fastness properties following an eco-friendly route[14]**.** Onion skin (*Alleum Cepa*) is another widely available resource for natural dye in India[1], which can also be utilized for colouration of wool and silk fibres[1]. Henna (*Lawsonia inermis),* madder (*Rubia Cordifolia, Rubia sikkimensis*), marigold (*Calendula officinalis*) are the other sources of natural dyes which can be utilized also, in view of their wide availability. Other dyes worthy of mention in respect of availability in India are alroot (*Morinda citrifolia*), safflower (*CarthamusTinctorius*), patangwood (*Caesalpinia sappan*), Hemp (*Datisca cannabina*), palas (*Butea monosperma*), Turmeric (*Curcuma longa*), Annato (*Bixa orellana*), Dolu (*Rheum emodi*), Promegranate fruit rind (*Punica granatum*) Babul (*Acacia Arabia*) etc.

Extraction of dye from the natural resources

Colouring components or dyes from vegetable matter is usually extracted [15-20] by boiling the vegetable matter in water for a period ranging from 1-2 h. Colouring component from the same quantity of vegetable matter can be extracted more, if the vegetable matter is pulverized and/or steeped in water overnighte mo7gm55 r1anate fruit rind 5.4o15. action of dert]T

suitable level by the addition of acid or alkali for successful dyeing. It is however reported in the literature[34, 35] that for extraction of coluring components fromd osu

-

Sericin as an UV Protector

Sericin is a second type of silk protein, which contain 18 amino acids, total amount of hydroxyl amino acid in sericin is 48.5%, there are 42.3 % is polar and 12.2% is non polar amino acid is present. It mainly envelope the fibroin and occurs mainly in an amorphous random coil, in β

11.

Table 1: Quantitative analysis test results of treated and untreated sample[18].

Bacteria	Finishing agent concentration in gpl	% of bacteria reduction after treatment
Staphylococcus	1	97
	2	97.9
	3	98.1
	4	98.4
	5	99.1

Table 2: List of few natural dyes with their medicinal activities

Plant	Parts used	Colour obtained	Pigment	Medicinal properties
Acacia catechu Willd.	Bark	Brown/ black	Catechin, Catechutanic acid	Used medicinally for sore throat and cough.
Adhatoda vasica Nees.	Leaf	Yellow	Adhatodic acid, carotein, quercetin	Used in bronchial infection
Aloe barbadensis L.	Whole Plant	Red	Barbaloin, aloe emodine	Fresh juice of leaves is cathartic and refrigerant used in liver and spleen ailments and for eye infections , useful in X-ray burns
Indigofera tinctoria L.	Leaf	Blue	Indirubin, Indican	Extract used in epilepsy and other nervous disorders; in the form of ointment used for Sores, old ulcers and piles.

- -

Conclusions

Natural dyes of vegetable origin are safe and environment friendly to dye natural fibre as natural dyes are virtually free from harmful chemicals. Use of forbidden heavy metals as mordant should be avoiy.5 0 T(.n a icals.a)- TD3>Tj/ 0 T(ironm)[(N.80Tc.1312 Tw9.2(aork)-9.9houl)-3ical

Table-1: Implications of Natural and Synthetic dyes

Elements	Natural dyes	Synthetic dyes
Production	Nature or from agriculture (renewable resources)	Petroleum origin (finite resources)
Advantage	Environment friendly or low impact dye	Diversity of colours, regulated (mastered) quality, reproducibility
Problems	Á Vast lands were needed to meet world demand	Á Toxic or dangerous chemicals or intermediary products
	Á Raw material and End-products: variable in quality, limited in quality	Á Environ mental Pollution
	Á Exploitation diversity: Overexploitation of species Á Environmental pollution(air, water,	Á Aquatic and oral toxicity

Opportunities of natural dyes for a greener textile and colouration industry

Atish Mukherjee
Eco-N-Viron, Serampore, Hooghly, West Bengal
E-mail: atishnaturalcolor@gmail.com, atish1836@rediffmail.com
Mob: 91-9836906376

Abstract

Dyes obtained from natural sources, such as plants and insects, have been used for decorative effect and as symbols of status for thousands of years. The mollusk-derived Roman purple (dibromoindigo) also called as *Tyrian purple*

- -

it is a vat class natural dye. Only 10gm/lit Sulphuric Acid and 10g/l Glauber's salt at 50˚C is required for developing (silk/wool) the blue shade of indigo. Hydrochloric acid and common salt should not be used for developing the blue shade of Indigo dye in case of silk and wool materials, but it is suitable for cotton. Sulphuric acid and Glauber's salt are suitable for these protein materials.

The fermentation breaks the dye to dissolve in the water and to be able to dye. Though a long tedious process, it is still in practice at some places in India and at different parts of the world. There is another way of dyeing the indigo which is practiced in Japan, is by preparing the *sukomo* or Indigo balls by pounding the Indigo leaves of

VAT

Selecting appropriate vessel to be buried under the earth for fermentation process has also been a challenge and a huge task on hand. Material properties of various materials used for vats in various places were studied. Traditionally it has been made mostly of clay or wood. But, today lot of dyers use plastic vats.

so, the direction of the flow of air needs to be regulated as the indigo vat is in open space. The wind direction, sunlight and heat could cause lot of fluctuations in the temperature, pH and the oxygen in the ambient air which delays or halts the fermentation reduction of the indigo in the vat.

Temperature

Temperature of the fermentation vat is one of the vital factors that govern both fermentation and dyeing process in dyeing with the Indigo. The temperature of the vat should remain similar to that of human body temperature that is the temperature could vary between 33^0 C and 37^0 C.

The less the temp, the difficult it is for the natural bacterial enzymes to break the stable water insoluble indigo structure to water soluble indigotin particle that dyes the natural fibres.
The main heat sources for the vat are:

1. The mixture of goat dung and cow dung, which constantly emits heat and maintains the heat.
2. The solar energy and the atmospheric temperature, that gets transmitted through the earth and the mixture of cow and goat dung.
3. The inputs to the vat such as the sugar content material, the alkaline material that is the caustic lime (Calcium carbonate)/ slack lime(calcium hydroxide), c in this case, and the seeds of Casia tora plant.
4. The heat generated through the interaction between the sugar content, alkaline material and the bacterial formation and fermentation.

There needs to be a balance in the kind of heat that is transmitted from outside the vat and the heat that is generated in the vat. The vat is used for dyeing only when the dye-bath is still. Stirring while dyeing in vat is not recommended as there would be lot of undissolved dye and lots of other aforesaid salts that would form a kind of layer that would affect the quality of color got from the vat and also the fastness of the color on the fabric, besides uneven dyeing.

Conclusion

Traditional practice of Indigo dyeing has always been responsible and sustainable practice on both small and medium scale of operation, though not responsible at large scale. Natural vat uses water and other ingredients as required rather than bulk use. It is one of the most responsible dyeing practices in the whole world, when practiced in the most traditional manner. It is important to disseminate the knowledge and create awareness. It has been a great learning experience to have interest, study and understand an Indigo vat. It behaves in many ways like a living being, that it could express itself. If it is ready for dyeing, if it needs something, it expresses in many ways than one. In this paper, an effort has been made to put in scientific views and understanding only, although there are many facets of Indigo vat

including its esoteric, mystic associations especially with regards to women, which are not discussed here.

Reference

1. Bagul, Dinesh. *Dyeing Techniques of Ajrakh & Malir: A Document in Ajrakh & Malir Craft of Barmer District, Rajastha*n. NID Craft Documentation R 0108. Ahmedabad: NID, 1993.
2. Gittenger Mattie. *Master Dyers to the World.* Washington DC: Textile Museum, 1982.
3. Humayun, Q M, ed. *Inter Regional Workshop on Natural Dyes.* Lucknow: National Handloom Development Corporation, 1993.
4. Khanna, Nalini. *Deesa Block Printing.* NID Diploma Project D 048. Ahmedabad: NID, 1980.
5. Mohan, Remya. *Shades of Blue: Collaborating with Weavers in Andhra Pradesh.* NID Diploma Project D 1393. Ahmedabad: NID, 2007.
6. Mohanty, B C**,** K V Chandramouli and H D Naik. *Natural Dyeing Processes of India*. Ahmedabad: Calico Museum of Textiles, Sarabhai Foundation, 1987
7. Mohanty, Nitesh, Ashwini Vaidya. *Natural Dyes through Toofan Rafai.* NID Craft Documentation R 0188. Ahmedabad: NID, 1999.
8. Pathak, Divya. *The Making of Ajrakh in Dhamadka.* NID Craft Documentation R 0181. Ahmedabad: NID, 1996.
9. Ramaswamy, Vijaya. *Textiles and Weavers in Medieval South India.* New Delhi: Oxford University Press, 1985.
10. Sahoo, Shalini. *Earth to Earth.* NID Diploma Project D 1106. Ahmedabad: NID, 2005.
11. Shah, Angana. *Dabu (Mud} Printing in Ahmedabad and Deesa.* NID Craft Documentation, R 0007. Ahmedabad: NID, 1980.
12. Singh, Gunjan. *Thulma and Chutka: Rediscovering the Tradition of Shauka Textiles.* NID Diploma Project D 1400. Ahmedabad: NID, 2007.
13. Singh, Smita. *Fleur de Neel: An Experiment with Natural Indigo.* NID Diploma Project D 1330. Ahmedabad: NID, 2006.
14. Singh, Vasundhara. *Mohar: A Tale of Natural Dyes and Block Prints in Rajasthan.* NID Diploma Project D 1430. Ahmedabad: NID, 2007.
15. Tolat, Padmini. *Natural Indigo and Its Use,* (Vol. 1-5). NID Diploma Project D 099. Ahmedabad: NID, 1980.
16. Varadarajan, Lotika. *South Indian Traditions of Kalamkari.* Ahmedabad: National Institute of Design, 1982.

Acknowledgement

Compilation of this paper has been possible by interactions with numerous craftspersons viz., Mr Yellappa of Uravakonda, Mr Abdul Jabbar Khatri of Damadka, Dr Ismail Khatri of Ajrakhpur. The author would like to dedicate this article to those craftsmen, who have been practicing Indigo dyeing in their own ways independently.

Use of natural colours in *Patachitras* by the *Potua* —— a pilot study in the district of Midnapur, West Bengal.

Debashish Mahalanobish.
Kala Bhavana, Visva-Bharati, Santiniketan, WB
E.mail:rouvya@yahoo.com
and
Tanny Dey
E.mail:pradiptodb@yahoo.com

Abstract

In the domain of art, crafts and paintings an indigenous type of rural paintings is found which is specially made by a section of the rural people known as '*Potua*'. For making these paintings, locally known as "*Patachitra*s", the artisans of this group follow the theme of the old stories, ancient rituals, the epics, contemporary issues etc. and exhibit them through their artwork. '*Patachitra*s', a means of livelihood for the '*Potua*s' as well as a means of amusement for the rural mass, not only have an aesthetic significance but also have some inner relevance with reference to modern art and paintings. These indigenous paintings have also some remarkable effects to improve the ambience of their dwelling houses and huts. Generally in "*Patachitra*s", natural colours are used on porous papers and cloths. This paper reports the observation of a pilot study that has been conducted by the authors in the area of Pingla, Midnapur District, West Bengal with a view to gathering an in-depth knowledge about the nature and the extent of use of natural colours in '*Patachitra*s' by the '*Potua*' of that locality. Authors' observation has been elucidated in this paper in the light of modern art and paintings, with special reference to indigenous

-

-

seeds are first removed from the fruit pods and rubbed by hands. Thus the colours are collected and kept in a container and dried in the sun, and then glue is added to make it ready for painting.

Green

The leaves of "*Kundri*" are collected and crushed by a pestle and then the pigments are collected and dried in the sun. Finally, the glue is added. The leaves of the Runner-beans, Flat-beans, Bottle-beans, Indian beans are also taken for the green colour.

Brown

The matured leaves of the teak are collected in such a manner that the stalks are removed before and then crushed by a pestle. Finally, requisite quantity of glue is added.

Blue

The flowers of Butterfly pea are either used directly by rubbing on the scroll for blue or the flowers are crushed and added with the glue.

Yellow

The roots of turmeric are used for getting yellow colour. The roots are crushed and squeezed and dried in the sun and then glue is added. The duration of drying or exposure to the sunlight gives different tonal variation of the yellow.

Gum preparation

The gum is generally prepared from the seeds of the "*Bael* fruit". The mucus like substance around the seeds and the seed itself are the source of gum. The seeds are crushed and mixed with requisite quantity of mild water to make the gum. The viscosity of the gum is maintained with addition of adequate amount of water. Alternatively, the "Potuas" purchase the powder of the gum from the local market also.

During the survey in the area of Pingla, two significant points have been observed:

1) Most of the artisans of this area are Muslims, but they use the stories of Hindu God and Goddess for their "*Patachitra*" paintings.
2) They not only use art-papers or cloths for their paintings but also they prefer to exhibit their paintings on the walls of their houses.

Observation and conclusion

From the points cited above, it may be mentioned that religion of the artisans does not affect the work of "*Patachitra*", which is very significant to the present day scenario of our country as well as the today's quarreling world. It is a very creative work, which generally reflects the inner urge of the artisans. The "*Patachitra*" carries a very traditional system of art and paintings. Along with the "*Patachitra*", the songs which are compiled by the artisans require a very creative aptitude. One point should be mentioned here that the dye used for the printing of the cloths is not similar to that used for the "*Patachitras*". The "*Patachitrakars*

Application of vegetable dyes in carpet industry

Priyanka Das
Kay International, Bhadohi, Uttar Pradesh.

Abstract

A natural dye not only has its application in the textile industry, but in the fashion and apparel industries also. In this article, a new aspect has been covered by exploring the possibilities of application of vegetable dyes in the domain of carpet industries.

Keywords: Vegetable dyes, Carpet Industry, Pre-treatment, Post-treatment, Washing fastness, Rubbing fastness

Introduction

Nature is full of marvels, many of which are yet to be revealed by the mankind to understand its wonderful phenomena. It imparts various uses in human life apart from the materialistic world that we live in, with all the man-made machines doing all the work, surrounding us with its super abilities to lessen our work. The most vital use of nature in our life is the food that we take in to keep us alive. Food, including vegetables, fruits and all edibles found in nature, as well as the man-made ones manufactured in various industries, also partially originate from the nature itself. So nature has its contribution in some way or the other in everything that happens around us in every moment. Now do the trees, fruits and vegetables from nature only serve the purpose of food in human life? Of course not, and all of us are pretty aware of its multipurpose uses too. For instance, what the clothes that we wear, are made up of? ... Fibres, and where do they come from? They are actually extracted from plants or in some cases, from their fruit, or from animals. Fibres have its use not only in making clothes but also for various others too. For example, ropes, gunny bags, shopping bags, carpets and many more. But does anyone like clothes or any other products without colors on it?.. ‘NO’.

Love for color is a natural instinct. Every individual has his own choice and liking for color. Whether it is icy appearance of the Himalayan ranges, or evergreen forests, or lush green agricultural fields, or trees laden with colorful ripe fruits, or the colorful butterfly moving from one flower to another, are centres of attraction over generations. A beautiful color is fascinating for everyone. Some people are simply crazy about colors. If something does not have color, they will simply dye on it, and if it has a color already, they will over dye it. The dying technique being as old as few millennium; all that’s new today is the number of different dyes that can be used. Many natural dyes are known for long time. Until the middle of nineteenth century, all dyes available to man came from natural sources. Most of these were natural extracts and few were animal products. The range of colors as well as utility of dyes was limited. Fiber dyes were already used in prehistoric times after the last ice age, around 1000 B.C. They consisted of fugitive stains from berries, blossoms, barks and roots.

They were early examples of so called direct dyes, i.e. dyes that color the fibre without special pretreatment of the dye-material or the textile.

The ability of natural dyes to impart color to textiles has been known since ancient times. The history of natural dyes is very interesting. The earliest authentic record of the use of natural dyes may be traced back to 2600 B.C in China. The fabric found in the tomb of Tutankhamen in Egypt, has been shown to contain Alizarin, a red pigment extracted from madder. More recently, Alexander the great, made use of a red dye (probably madder juice which contains Alizarin dye) which he used to sprinkle over his army to fox his Persian enemies by making them think that his soldiers were wounded. By the 4^{th} century A.D, dyes such as woad, madder, weld, Brazilwood, indigo and dark reddish purple were known.

Natural dyes are a class of colorants extracted from vegetative matter and animal residues. The raw material for the production of natural dyes is mostly vegetable matter such as seeds, leaves, roots, barks or the heartwood of the plants. Some of the plants recommended for the production of natural dyes for dyeing of textile substrates are given below in Table 1.

Natural dyes are produced from different parts of plant e.g. from roots, barks, heartwood, leaves, flowers, gum like secretion from insects, seeds etc. Since plants are grown in different climatic conditions and are not scientifically cultivated, the collection of color bearing components may not be possible at any given time. Apart from this, the moisture content and maturity of collected materials impart variation in extracted color components. For example, over dried bark, flowers, seeds, loose color components due to degradation. The natural color and hue of a dye can be altered by treating with metal salts. If the dye is of plant origin, the color may vary depending on the soil properties, part of the plant, season of harvesting, cultivation practices, etc. Natural dyes lack color fastness to various agencies. ‘Mordants’ are used to improve color fastness of dyes. Mordants form insoluble compounds with dye within the fibre. They enhance the color pick up and help improve the fastness of dyes considerably. The dyes which have electron donating groups (O-hydroxyl) in their structure are capable of forming a complex with transition metal ions. These dyes are considered under the class of mordant dyes. Mordanting can be carried before or after dyeing, depending upon the requirement.

A natural dye not only has its application in the textile industry, but also in fashion and apparel industries, and to bring a new aspect, it is also exploring the fields of carpet industries. This new area of natural dye application has emerged due to one and only reason i.e. eco-friendliness of the product. Carpets are manufactured in many regions in India which are then exported to the foreign countries. Cities like Jaipur, Panipat, Delhi, Varanasi, Gopigunj, Mirzapur and Bhadohi (popularly known as the Carpet City) are famous for producing carpets in India. Mostly these are woolen carpets. Viscose or Polyester yarns are also used to enhance the aesthetic value of rugs, primarily to attract foreign customers. Exporters from different places are trying various innovative ways and adopting various new techniques to boost business with foreign buyers. Amongst these newly adopted techniques, one is the use of natural dyes for dyeing of woolen yarns in carpets. The heightened awareness about the hazards caused by usage of synthetic dyes and chemicals during the dyeing procedure, people are becoming more conscious about their health as well as their

environment. Most of the foreign customers prefer natural dyes over synthetic dyes nowadays, hence this re-emergence of natural dyes in the market. A brief description on the dyeing process and recipes of some shades dyed with natural dyes on wool for carpets are summarized below.

Experimental

General procedures and considerations for dyeing wool with natural dyes

Material

Wool: Wool being protein fibre, contain functional groups for absorbing natural dyes. Carpet wool is generally dyed in hank form.

Chemicals used

All the chemicals used are either of laboratory reagent grade or of commercial grade.

Considerations

% Shade**:** All shades here are reported as percentage on weight of material (owm). Generally, the amount of dye required is less in case of wool.

Material to liquor ratio (MLR): Material to liquor ratio for reported dying is maintained at 1:20 for wool.

All dyes and chemicals should be carefully stirred and dissolved in the dye bath before the wool is added.

Procedures

Scouring of wool: Wool to be dyed should be pre-scoured with 2gpl of non-ionic detergent at 60^0 C for about one hour.

Soaping: For getting good wash fastness, after dyeing; all samples should be soaped with non-ionic detergent (0.5 gpl) at 60^0 C for 20 minutes. After this, the samples should be given hot wash followed by cold wash.

Water: Dyeing with natural dyes should be carried out by using soft water. Hard water containing metal ions such as iron, calcium and magnesium tend to give dull shades.

pH: The pH of each dye bath should be

times is added on the weight of dye, stirred well and kept for 20 min. The color of solution becomes light yellow. If the color does not change more sodium hydrosulphite and caustic soda are added to obtain the pH of 11-12. Material is added to the dye bath and dyed for 20-30 min. It's then taken out, exposed to air, again dipped in the same solution and dyed for another 20-30 min. Sodium hydrosulphite and caustic soda are added constantly to keep the color of bath pale yellow throughout the dyeing process. Finally, the hank is taken out and kept in air till blue color develops. Soaping is done as indicated.

$5a_1$. Dye 3%, procedure as reported above.

Assessment of color fastness to washing

Washing fastness:

Norm : IS 5461:1993, Test Method : IS 3361:1979

Assessment of color fastness to rubbing

Table 2: Data for fastness properties of natural dyed carpet wool

Sl.no.	Procedure Number	Dye %	Light Fastness		Rubbing Fastness			Washing Fastness		
			Fading	Color Change	Wet	Dry	Color of stain	CC	CB	Color Change
1.	1(a)	Acacia catechu 1.5%	3	light	4-5	4-5	same	4	5	__
2.	1(b)	Acacia catechu 8%	4-5	light	3-4	3-4	same	5	5	__
3.	1(c)	Acacia catechu 5%	3	yellow	3-4	4	same	4	5	redder
4.	2	Mallotus philippinensis 6%	1	light	3	3	same	4	4-5	__
5.	3	Quercus infectoria 6%	2-3	yellow	4-5	4-5	same	3-4		

-

- -

Table 1: Specification of fabrics used

Parameters	Jute	Cotton

Table 2: Various conditions and absorbance of aqueous extraction of various colour components

Extraction variable	Absorbance of colour component at $_{628\ nm}$ for Jackfruit Wood Extraction	Absorbance of colour component at $_{490\ nm}$ for *Tesu* Extraction	Absorbance of colour component at $_{471\ nm}$ for Manjistha Extraction
Time, min 5	2.50	-	-
10	2.62	-	-
15	2.71	2.426	2.212
30	**2.77**	2.457	2.225
45	-	2.458	2.238
60	2.68	**2.462**	**2.247**
75	-	2.460	2.235
90	-	2.427	2.205
120	2.60	2.213	1.256
Temperature, ^{o}C			
30	0.72	2.345	1.574
45	-	2.356	1.892
60	1.55	2.391	2.168
75	-	2.434	2.187
90	2.63	**2.462**	**2.247**
100	**2.77**	2.358	2.046
Material-to-liquor ratio			
1:2.5	2.66	-	-
1:5	2.69	2.435	2.043
1:10	**2.77**	2.443	2.120
1:15	2.54	2.453	2.151
1:20	2.23	**2.462**	**2.247**
1:25		2.460	2.239
1:30		2.457	2.237
1:40		2.431	2.202
*p*H			
4.0	1.49	1.918	1.567
5.0	1.60	-	-
6.0	1.99	2.016	1.572
7.0	-	2.319	2.103
8.0	2.01	2.324	2.169
9.0	-	2.339	2.075
10.0	2.69	2.422	2.188
11.0	**2.77**	**2.462**	**2.247**
12.0	2.73	2.220	2.168

In each case, after the dyeing is over, the dyed samples were repeatedly washed with hot and cold water and then finally, the dyed samples were subjected to soaping with 2gpl soap solution at 60 C for 15 min, followed by repeated water wash and line dried.

Determination of *K/S* Value and Brightness Index

The *K/S* value (surface colour strength) of the undyed and dyed jute and cotton fabrics was determined by measuring surface reflectance of the samples using a computer-aided Macbeth 2020 plus reflectance spectrophotometer, using the following Kubelka Munk equation [14] with the help of relevant software:

Where, K is the coefficient of absorption, S, the coefficient of scattering; $C_{d,}$ the concentration of the dye; and $R_{max,}$

systems (A), (A′), and (B′), the effect of increase in dyeing time is much subdued; the optimum dyeing time is found to be 90 min. Rate of dyeing for fibre-mordanting system (B) is, however, found to be sharp for 60-90 min period of dyeing. This higher rate of dyeing above 60 min and up to 90 min in case of fibre-mordanting system (B) may be due to the possible reduction in activation energy required for absorption and fixation of dyes on fibre surface by jute-hemicellu-COO^{-}…Fe-ion complex formation, which is not possible in cotton.

Keeping other dyeing variables constant, with

the optimum mordant concentration may be considered to be around 20-30%. However, there is noticeable loss in tensile strength after mordanting bleached jute and cotton fabrics with more than 20% mordants. Hence, the use of more than 20% mordant concentration for mordant systems (A), (A′) and (B′) is not recommended. But despite some strength loss, the use of 30% mordant concentration may be allowed for obtaining much higher *K/S* value for fibre-mordanting system (B), as the increase in *K/S* value for this d

common salt respectively on the surface colour strength (K/S values) for dyeing of bleached fabrics with *Tesu* and *manjistha* after double mordanting (20% *harda* followed by 20% aluminium sulphate).

Relevant data given in Table 5 indicates that all other variables remaining prefixed and unaltered with increase in time of dyeing (45 – 120mins), K/S value (surface colour strength) slowly increases upto 60 min and then slowly decreases for both the natural dyes *tesu* and *manjistha*. Rate of dyeing is found to be sharp for 45 – 60 mins period of dyeing. Higher rate of dyeing is observed upto 60 min dyeing time in case of double mordanting system. This may be due to possible reduction in activation energy required for absorption and fixation of dyes on fibre surface by jute hemi

fibre mordant concentration some strength loss has been occurred. So the optimum concentration of moradant should be 20%.

Data in Table 5 shows slow increase in K/S value with increase in concentrations of extracted dye liquor from *tesu* upto 50% (on the basis of % solid *Tesu* powder), above which it almost levels off reaching almost the saturation level. So, optimum cane is 50%.
Corresponding data in Table 3 shows gradual increase in K/S values with increase in concentrations (on the basis of % dry solid mass of Manjistha i.e. source material) extracted dye liquor from Manjistha reaching almost saturation level for use of 40% Manjistha colour concentration in case of double mordanting system. So, for jute, K/S value is maximum at 40% dye concentration level and then falls.

Data in Table 5 indicates that the optimum concentration of common salt for *Tesu* dyed jute fabrics is 10 g/L, as the K/S values are found to be maximum for use of this concentration of salt in the dye bath. The addition of an electrolyte (common salt) to the dyeing liquor in the dye bath in case of dyeing with a mordantable anionic dye like *Tesu* extract expectedly increase the exhaustion of the dye on the cellulosic or ligno-cellulosic fibres. They dissolve completely in the aqueous dye liquor at different temperature of dyeing and increase the force of repulsion between the dye molecules and water so that the dye molecule are more attracted to the cellulosic or ligno-cellulosic fibres. But higher amount of salt/electrolyte above a certain limit causes retardation effect in the dye absorption.

Corresponding data in Table 5 show that optimum common salt concentration is 10 gpl, as the K/S value is found to be maximum for use of this concentration of common salt in the dye bath. After that K/S value decreases. The addition of an electrolyte (common salt) to the dyeing liquor in the dye bath in case of dyeing with a mordantable anionic dye like *Manjistha* expectedly increase the exhaustion of the dye on the cellulosic or lingo cellulosic fibre. But higher amount of common salt/electrolyte causes retardation in dye absorption.
From this study of process variables, in case of *tesu* dyed jute fabric, it maybe therefore summarized that the observed optimum conditions of dyeing are time 60 min, Temp. 100^{o}C, MLR 1:20, pH – 11, mordant cone – 20%, concentration of dye (% of colour source material) 50% and concentration of common salt 10 g/L for double mordanting system. For *manjistha* dyed double mordanted jute fabric respective optimum dyeing conditions are 60 min time, 90°C temperature, MLR 1:20, pH 11, mordant cone – 20%, concentration of dye (% of colour source material) 40% and concentration of common salt 10 g/L

Conclusions

1:30 MLR, for all the fibre-mordanting systems; 11.0 *p*H for all the fibre-mordanting systems; 20% (owf) mordant concentration for the fibre-mordanting systems (A) and (A′) and (B′), and 20-30% for fibre-mordanting system (B) and 15 gpl common salt concentration for all the fibre-mordanting systems

The optimized conditions of dyeing of bleached jute substrates with *tesu* extract are: 60 min dyeing time for double mordanting systems; 100^{o}C dyeing temperature; 1:20 MLR ; 11.0 *p*H ; 20% (owf) mordant concentration for the double fibre-mordanting systems (*myrobolan* followed by aluminium sulphate); 20-40% dye concentration for all the fibre-mordanting systems and 10 gpl comm

Table 3: Brightness index, surface colour strength, colour differences and colour fastness of dyed (aq. extract of jackfruit wood 20%) jute and cotton fabrics after single mordanting with selective mordants

Mordant conc., %	Fabric	Dye conc. %	Shade obtained	Surface colour strength and colour difference			BI
				K/S value at $_{max}$	ΔE		
Nil (Control bleached fabric)	Jute	0	---	0.80	---		38.20

Table 5: Data showing the effects of dyeing process variables on surface colour strength and dye uniformity for pre-mordanted bleached Jute Fabric and dyed with *Tesu* & *Manjistha* separately

Name of the Variable		*Tesu* (aq. extract of flower petal powder)		*Manjistha* (aq. extract of grinded root)	
		K/S at λ_{max}	CV of K/S	K/S at λ_{max}	CV of K/S
Time (Min)	45	7.07	3.14	4.69	5.41
	60	7.63	4.21	4.25	5.91
	90	7.05	4.67	5.73	6.2
	105	7.42	5.12	5.71	5.88
	120	7.07	4.99	6.17	5.41

Materials and Methods

Materials

Plain weave bleached loom state silk fabrics having 204 picks/dm and 212 picks/dm, 50g/m^2 in weight is used for the study. Punica granatum dye, obtained from M/s ALPS Industries India was used after purifying it by dissolving in methanol, followed by filtration and recrystallisation. All the chemicals used in the study were of laboratory reagent grade.

Degumming and bleaching of silk

The loom state silk fabric was degummed at 900C for 1.5 hour in an aqueous solution containing soap (6.0 g/L) and sodium carbonate (2.0 g/L). the degummed silk samples was bleached at 850C for 1 hour in a solution containing hydrogen peroxide (0.9%), non silicate stabiliser (0.15%) and sodium carbonate (0.1%). Material –to-liquor ratio for both degumming and bleaching operations was maintained at 1:20. Bleached sample was washed at 700C for 10 mins, cold washed and finally dried.

Concurrent dyeing and finishing of silk with pomegranate and itaconic acid

Silk fabric were dyed and finished simultaneously following exhaust-dry-iron-cure

100^0C. The weight gain (%) was then calculated on the basis of initial dry weight of degummed silk (W2) using the following relationship weight gain (%) = $(W_1-W_2)/W_2$ x 100

Measurement of tensile properties

Breaking strength of some sele

Table 1: Effect of itaconic acid application level on dye receptivity and mechanical properties of silk fabric dyed with *Punica granatum*

Itaconic acid	Potassium sodium tartrate	Weight gain	o (1Tj5.9563)]T867 0 TDe

degree of potassium sodium titrate catalyst esterification reaction leading to substantial cross-linking of i) silk fabric ii) *Punica granatum* and linking of dye and silk fabric is much improved manner as evident from the data given in Table 1.

Study of IR spectroscopy (data not shown) further supported the reactions detailed in the above explanation.

Comparison of properties of silk fabrics dyed with Punica granatum in the presence of inorganic salts and itaconic acid

- -

Conclusion

Simultaneous dyeing and fi

Natural dye and the historical concept of Tie-dye —— the first fabric design of human civilization

Mrinal Kanti Sarkar
Visva- Bharati University, Department of Silpa-Sadana, Textile Section,
Sriniketan, Birbhum, West Bengal-731 236

Abstract

A naturally dyed organic textile is non-toxic and safe for everyone. It is biodegradable and eco-friendly. Tie-dye dates back to ancient times. Tie-dye became fully developed in China during the Tang dynasty (618-906 A.D.) and in Japan during the Nara period (552-794 A.D.). The availability of silk and hemp, which are very receptive to the resist technique, made these countries' art outstanding. Some early tribes in Western China, South East Asia, and Central America tied and dyed the threads before weaving their cloth. Varied styles of tie-dye have emerged to distinguish the different nations of Africa. The Indian tie-dye technique called *Bandhani*, or *Bandhni* or *Bandhej*, is the oldest tie-dye tradition which is still in practice. The Malay-Indonesian name for this technique is *Plangi*.

Keywords: Bandhni, Ikat, Non-toxic, Tie-dye.

Introduction

Natural dye has a long and rich history stemming from almost every human civilization culture. It is important because it utilizes naturally occurring materials to create color without the use of chemicals or salt. A naturally dyed organic textile is non-toxic and safe for everyone. At the end of its life, it is biodegraded back into the soil without hurting the earth. Tie-dye dates back to ancient times along with beads, shells, and other ornamentation, our ancestors tie-dyed. Think to the story of Joseph, son of Jacob, in the Bible's Old Testament. He had a beautiful coat of many colors; the envy of his brothers. Could it have been tie-dyed? Tie-dye became fully developed in China during the Tang dynasty (618-906 A.D.) and in Japan during the Nara period (552-794 A.D.). The availability of silk and hemp, which are very receptive to the resist technique, made these countries' art outstanding. Some early tribes in Western China, South East Asia, and Central America tied and dyed the threads before weaving their cloth. When it was woven into material, beautiful designs appeared where the white lines of the tie contrasted with the colored dyes. This method is known as *ikat*. Early dyes were extracted from roots, flowers, leaves, and berries. These include blackberries, lichen, safflower, marigold, onion, red cabbage, sage, and indigo. Although these dyes are still used today, synthetic dyes have been developed that are permanent, quick-setting, safe, easy to use, and are ensured by accurate formulas. As in ancient times, we still use natural fibers for tie-dyeing. Silks from China, cottons from Egypt, and rayon from Bali are still highly prized. Hemp has always been used as a durable and dyeable natural fabric. The following picture shows some common sources of natural dyes:

These have been passed down in some families as prized possessions, and many can be found in museums today. The natural dyes have faded, but the designs of flowers and detailed misty landscapes are spectacular. These kimonos exhibit interesting variations in the use of tie-dye. One variation was the creation of a white area by tying off a large piece of the material before dyeing. Ink would then be used to draw pictures on the white area. In another design, rice would be tied into the material in little circles, so that when the material was dipped in blue dye mainly Indigo, designs of little white circles would be scattered over the deep blue kimono.

Tie-dye of other countries —— the 60's and beyond

Other forms of tie-dye can be found in other countries around the world. Varied styles of tie-dye have emerged to distinguish the different nations of Africa. The Indian tie-dye technique called *Bandhani*, also known as *Bandhni* and *Bandhej*, is the oldest tie-dye tradition which is still in practice. The Malay-Indonesian name for this technique is *Plangi*. The technique involves a design made of dots, in which many small points are tied with thread before immersion dyeing. In the U.S. during the Roaring '20s, pamphlets were printed that gave directions on how to decorate home with tie-dyed curtains and pillows. During the Depression, girls cut up cotton flour sacks, tie-dyed them, and then sewed them into clothing, curtains, and tablecloths. When times are rough, tie-dyeing has been a way to brighten peoples' lives. Tie-dye came back in style in the 1960's when a great movement emerged among young people that emphasized individuality. It was time to "do your own thing." Each person could make a statement by tie-dyeing clothes with a personal combination. Tie-dyed sheets were used as room dividers and wall hangings. Silk and cotton banners were used as backdrops for rock and roll concerts. Since the 1980's, tie-dye has seen a reemergence as style and as a highly skilled, difficult and labor intensive art form. Many different colors can now be put on one item to get intricate detailed designs in brilliant colors. The dyes, which used to fade so badly, have been replaced by dyes that are permanent and easier to use. They can be in bright rainbows, toned down blues, purples, or earth-J-19.08 -1.15ao the 198a reemgetTa8l9Twiiolves l-Tw[ea.nThe na02

- -

Picture of Tie Dye in modern style

Revolution of Colors: Impact on our fragile environment

Joydeep Bhattacharjee* and Matthew L. Reid
Plant Ecology Laboratory
Department of Biology
University of Louisiana, Monroe
LA- 71209, USA
*E-mail: joydeep@ulm.edu

Abstract

Colors have played a large role in cultural practices throughout human history, and this trend is no different today. Fabrics are dyed with a variety of colors to help us express emotion and distinguish status. Until the mid-1800s, all dyes originated from natural, plant-based material. After the creation of synthetic dyes, there was a true revolution of color. Colors became easier to produce and apply, leading to a rapid expansion of colors throughout society. Unfortunately, this revolution of color extends beyond society and into the natural world. There is growing evidence that the processes used

Aniline Yellow was commercialized in 1864 as the first commercial azo dye, a year after Aniline Black.

In addition to the dyes themselves, the garment finishes are often equally as harmful. We will save discussion on garment finishes for another post, but just briefly, they are used for creating wrinkle-free, stain resistant, flame retardant, anti-static, anti-fungal, anti-bacterial, odor-resistant, permanent-press, and non-shrink fabrics. They can also be used as softening agents, and for creating other easy-care treatments. In fact it is often the dye fixative, used to bond the dye color to the fabric, which causes the most problems. All of these can be particularly challenging for people with chemical sensitivities.

using plants for multiple purposes and maximizing their dying potential, such as genetic engineering.

So, what is it in the synthetic dye manufacturing process that hurts the environment? Back to basics, almost all industrial dye processing involves a solution of a dye in water, in which the fabrics are dipped or washed. However, what is interesting is not the process until this, but rather what happens after this is where the concern lies. After dying a batch of fabric, it's cheaper to return the used water to its source without much or any cleansing/processing/chemical unloading – dye effluent, than it is to clean and re-use the water in the factory. While there are countries where strict measures are enforced to ensure that the effluents meet the clean standards, several countries also lack such measures and pose a threat to the environment. With global outsourcing, it is very difficult to track if the protocols of effluent treatment are followed in the countries where the manufacturing has been outsourced.

For example, in August 2007, the Chinese government investigators crawled through a hole in the concrete wall that surrounds the Fuan Textiles mill in southern China and launched a surprise inspection of the plant. Authorities discovered a pipe buried underneath the factory floor that was dumping roughly 22,000 tons of water contaminated from its dyeing operations each day into a nearby river, according to local environmental-protection officials. Villagers say that fish died, and the lifeless river turned to sludge. What they found caused alarm at dozens of American retailers, including Wal-Mart Stores Inc., Lands' End Inc. and Nike Inc., which use the company's fabric in their clothes (Spencer 2007).

Prices of fabric and clothing imported to the U.S. have fallen 25% since 1995, partly due to the downward pricing pressure brought by discount retail chains. One way China's factories have historically kept costs low is by dumping waste water directly into rivers. Treating contaminated water costs upwards of about 13 cents a metric ton, so large factories can save hundreds of thousands of dollars a year by discharging waste water directly to rivers in violation of China's water-pollution laws. Similar violations have been reported by CBS News 2010, about a textile dying plant (mainly jeans) in Lesotho in southern Africa, where contaminated effluent was seen leaking into the ground water-table and a local river. Certain textile factories in Mexico have also been found guilty of letting rivers near jeans factories turn dark blue from untreated, unregulated dye effluent. Local residents and farmers report health problems and wonder if the food they are obliged to grow in nearby fields is safe to eat anymore.

What's the Alternative to Synthetic Dyes?

So what is the dye industry doing, or rather innovators in the clothing industry who want to change the dye industry? Responsible dye manufactures are investigating ways to treat their dye effluent with organic materials and bacteria, rather than chemical treatments, and improve dye manufacture and processing to minimize hazardous chemicals used.

Natural, plant based dyes are steadily making a comeback into mainstream fashion. In the United States, government legislation aims to

vegetable oil. According to the Vegetable Printing Act of 1994, the increased use of vegetable oils would reduce reliance upon non-renewable energy resources, use fewer environmentally damaging products, reduce volatile organic compound emissions and increase the use of renewable agricultural products [25].

However, once all the factors are taken into consideration, including those that concern the overall well-being of the planet, then any alternative resource ought not to be ignored. Indeed, there are a number of initiatives (such as phytochromography - Shawn 1999, shift from solvent-based to aqueous-based printing, physicomechanical treatments of effluents, to name a few - Lacasse and Baumann, 2004) currently being pursued throughout Europe and the United States that demonstrate the seriousness with which governmental institutions have taken the issue of vegetable-sourced alternatives in the dyeing and printing industries.

Some Interesting Facts

Religious paintings always depicted the Virgin Mary in blue robes particularly ultramarine which was the most expensive natural dye.

A natural dye name Tyrian purple was the most expensive dye in the ancient times and relegated to royalty alone. Tyrian purple, a natural dye, is made from Mediterranean shellfish and was extensively used in the ancient Phoenician city of Tyre. It takes approximately 8,500 shellfish to produce one gram of this dye. The dye is also mentioned in the Bible.

Species of scaled insects, Cochineal, is used to produce deep red or crimson and was probably used by the Aztecs and the Mayans.

Red fabric was discovered at Tutankhamen's tomb which was found to be dyed with madder, a plant-based dye.

Alexander the Great, when he conquered Susa around 541 BC, talks of the discovery of purple robes.

In the biblical Book of Exodus, Kermes (from the Kermes insect) is mentioned as the source of scarlet colored linen.

References

1. Chemical Sensitivity Foundation. 4 Wren Drive, Topsham, Maine USA. (http://www.chemicalsensitivityfoundation.org/ : accessed on Nov. 4th 2011)

2.

Dyeing of cotton yarns with *Latkan* wood, *Hena*, *Lac* and *Turmeric*

A.K. Samanta
Department of Jute & Fibre Technology, Institute of Jute Technology,
University of Calcutta,
35 Ballygunge Circular Road, Kolkata-700 019.
&
Sunanda Mitra Roy
Department of Fashion & Apparel Design, Rani Birla Girls' College,
38, Shakespeare Sarani, Kolkata-700 017.

Abstract

In today's world, where there are imminent threats to the environment from toxic synthetic chemicals and dyes a thorough introspection of scientific achievements towards alternative and eco-friendly natural products is very essential. Hence, the environment scientists and chemical technologists are trying to create an eco-friendly atmosphere throughout the globe. Naturally, this has also created ripples in the world of textile science where natural products in general and natural dyes in particular are heading towards a period of renaissance. Keeping this background information in mind, an attempted has been done in the present work to dye cotton yarns in pink, green, red and purple shades (as per customer's demand at that period). In this work *Henna*, *Latkan* wood, *Turmeric* and *lac* dyes were used to produce the targeted shades. From the above study it may be concluded that the yarns dyed with *Latkan*

apparels. It is highly pleasing to know that Indi

Fig. 3: *Lac* (C.I.75450)

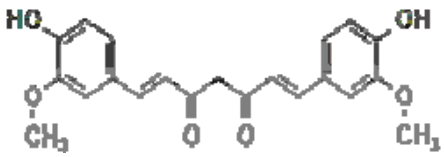


Fig. 4: *Turmeric* (C.I. 75300)

Methods

Dyeing of cotton yarn with *Latkan* wood & *Henna*

Extraction procedure of natural dyes used

The extraction of the dye was done by boiling the *Latkan*

Effect of various mordants in dyeing with Henna

The cotton yarns mordanted with *myrobolan* solution and dyed with *Henna* produced light *pista* colour whereas the yarn first mordanted with *myrobolan* and second mordanted with aluminum sulphate produced *pista* colour and the yarns first mordanted with *myrobolan* and second mordanted with ferrous sulphate produced shabby green colour. It was further noted that with increase in the percentage of concentration of mordant from 5% to 10 % in case of the second mordanting with ferrous sulphate and aluminium sulphate there is increase in shade depth which is expressed in terms of K/S values shown in Table 2 and the shade card.

Effect of various mordants in dyeing with Lac

The cotton yarns mordanted with *myrobolan* solution and dyed with *lac* produced light pink colour whereas the yarn first mordanted with *myrobolan* and second mordanted with aluminum sulphate produced brilliant red colour and the yarns first mordanted with *myrobolan* and second mordanted with ferrous sulphate produced grey colour. It was further noted that with increase in the percentage of concentration of mordant from 5% to 10 % in case of the second mordanting with ferrous sulphate and aluminium sulphate, there is increase in shade depth which is expressed in terms of K/S values shown in Table 3 and the shade card.

Effect of various mordants in dyeing with Turmeric and finally topped with Lac

The cotton yarns mordanted with *myrobolan* solution and dyed with turmeric produced light yellow colour whereas the yarn first mordanted with *myroblan* and second mordanted with aluminum sulphate produced brilliant yellow colour and the yarns first mordanted with *myrobolan* and second mordanted with ferrous sulphate produced greyish yellow. Again this treated and dyed samples when was further dyed with *lac* dye solution further produced faded red, chrome red and reddish grey colour. It was further noted that with increase in the percentage of concentration of mordant from 5% to 10 % in case of the second mordanting with ferrous sulphate and aluminium sulphate there is increase in shade depth which is expressed in terms of K/S values shown in Table 4 and the shade card.

Effect of wash fastness test on various dyed yarns dyed with Latkan wood, Lac, Turmeric and Henna

The yarns dyed with latkan wood, lac, turmeric and Henna had fastness properties from moderate to good when measured manually by grey scale to change in colour and grey scale to staining and was also measured by using reflectance spectrophotometer in terms of K/S values shown in Table 1, 2, 3 & 4.

Batik on cotton fabric with natural dyes

Lina Bhowmik
ATDC-IGNOU Community College, Salt Lake, Kolkata

Abstract

Batik work is sill now limited in mainly Naphthol colour and partly in solubilised vat dye, because both of them can be applied on fabric in cold condition. The excellence of batik work is its natural creation of crack design with the help of wax which is a good resisting material. Batik with natural colour is not practically possible as during steaming, which is a must after printing, wax melts down and it becomes very difficult to remove it from the fabric. In this work an attempt has been taken for batik work with natural colour which has a huge demand in our country and abroad in the presenylt is it b-friendl

work with the help of wax is its natural and unique crack design. Batik with other colour is not practically possible as during steaming, wax is melted. The present article is based on an attempt to carry out batik work on cotton fabric with natural colour because of its demand in export market and eco-friendliness. Normally printing with natural dye has been carried out in many cottage sectors using block and screen. But batik work with natural colour which gives us unique design on the fabric has not yet been tried.

Materials and methods

Cotton fabric

Plain weave loom state cotton fabric was used in the present article.

Natural dyes

Onion skin, Turmeric and Harda were used as vegetable colourants for this work.

Chemicals

Aluminium sulphate, ferrous sulphate and copper sulphate were used as mordanting agents. All other chemicals used in this study were either of laboratory reagent grade or of commercial grade.

Methods

Combined scouring and bleaching

Combined scouring and bleaching of desized cotton fabric was done as per the standard method.

Dyeing of cotton fabric

Dyeing of bleached cotton fabric was carried out at 90^0

Removal of wax

For better removal of wax from the fabric after steaming, the fabric was ironed at a very high temperature keeping the fabric in between two news papers. All most 90% wax was transferred to paper and rest 10% of wax was removed by boiling with non-ionic detergent 5-7 minutes.

Conclusions

The process of batik work is an innovative method which produces a unique design on the fabric.

Since the removal of wax is not an easy process, hence reuse of the removed wax is not possible.

Though found costly, it may be suitable for producing specialty products in cottage sector.

Copper Sulphate should be used below the permissible Eco-Marks level.

References

1. S Ray Maulik and L Bhowmik, Dyeing of jute and cotton with some selective natural dyes, *Man Made Text India*, 49 (1), (2006), pp 23-29.
2. S Ray Maulik and L Bhowmik, Studies on application of some vegetable dyes on cellulosic and lignocellulosic fibre, *Man Made Text India*, 49 (4), (2006), pp 142 – 148.

Mata-ni-Pachedi'- 'Kalamkari' of Gujarat

Amita Dutta
J.D. Birla Institute, 11 Lower Rawdon Street, Kolkata 700 020

Abstract

Mata-ni-Pachedi, (cloth behind the idol of Mother) is a sparsely known art practiced by Vaghari community in Ahmedabad. The worshipers are leather workers, farm laborers, sweepers etc and Vagharis themselves. They made shrines by using these pieces and sung the glory of Mata and made animal sacrifices if their wishes were fulfilled. All the materials, (dyes, cotton fabric and *kalam*) used

hung behind an icon, made them unique. Traditionally, the shrine cloths are made for ritual use by members of castes such as leather workers, farm laborers, sweepers, or by the *Vagharis* themselves. *Vaghari* community gradually settled on the outskirts of towns/ villages as they shifted from a semi-nomadic stage to a fixed state. Even today, *Mata-ni-Pachedi* serves as a rear wall to the main shrine for this community, who still follow their original style of worship.

When any of the *Mata's* devotees suffers illness or misfortune, he goes to the *Mata's* shrine and vows to make a sacrifice to her if she will relieve him of his trouble. If his wish is granted, he pays for the shrine to be cleaned and decorated, and an enclosure made up of *Pachedis* is erected, with the *Chandarvo*, the great square shrine canopy, draped above it. This was followed by singing the glory of *Mata* and the ritual sacrifice: the cooking and eating of a young goat. There is always a depiction of a *bhuvo* **(**priest), leading a sacrificial animal to the *Mata*, on a *Pachedi*, or *Chandarvo.* The **'***Chitaras'* are the artists who painted the shrine hangings, and **'***Jagorais'* are the singers who interpreted the *Pachedis*. A ceremony of chants and a trance-inducing dance was conducted by a priest-shaman, known as a **'***Bhuvo'*.

Although the technique of making the *Mata-ni-Pachedi* or the *Mata-no-Chandarvo* is now practiced only by a handful of *Vaghari* families settled in Ahmedabad and in Kheda district, the craft was previously prevalent in the region of Aghar and Dholka as well. In addition to catering to the commissions received from a number of ethnic communities such as the *Bharwad*, the *Koli*, the *Rawal*, the *Vaghri*, the *Rabari* and the *Deviputar*, the craftsmen also practiced direct selling by visiting places such as Dholka, Dhanduka, Barda, Limdi, Rajkot and Bhavnagar during Navratri.

Pachedis are on display at the Lalbhai Dalpatbhai Museum and Calico Museum in Ahmedabad. Baroda Museum and Art Gallery in Vadodara also exhibit *Pachedis.*

Mythology and Composition

In a great battle between *Shiva* and the *asura* Raktabija, every drop of the *asura's* blood that fell to the earth, gave rise to more and more demons. The gods then turned to *Shakti,* to annihilate the *asuras*. The fierce goddess pierced the demon's body and drank all his blood, thus saving both the worlds. Thus the goddess *Shakti*, the destroyer of evil is always depicted with weapons in all her ten arms looking fierce and commanding, invoking awe and fear in the onlooker. Sometimes she carries a bowl of blood in one of her arms.

Both the *Pachedi* and the *Chandarvo* are always framed with a bold border, which is divided into a line of single color and a band of decorative linear patterns which is colloquially termed as a **'***lassa patti'*. Traditionally *Pachedis*C

and proportions of the motifs are interpreted differently according to the artist's sensibility and visualization.

Some believe that the Goddess have a hundred forms, others say it is sixty-four. She is depicted in any of these along with the appropriate iconographic details and attributes. The Goddess in seven forms is worshipped during the nine days of *Navaratri* festival. Some of the names are *Amba Ma, Momai Ma, Dasha Ma, Bahuchar Ma, Karka Ma, Meledi Ma, Hadaksha Mata.*

Many *chitaras* still make the entire painting with the **'***kalam'*, using blocks only for printing the borders. Thus, even today, the artisans make these paintings using the same methods followed 200 years ago.

The motifs of the *Mata-ni-Pachedi* are printed on with large wooden blocks or painted, using a dye made out of rusted iron which has been soaked for a week in jaggary solution thickened with a flour of tamarind seeds. This reacts with the myrobalan mordant to produce black.

Most of the spaces between the black printed figures are painted with alum and coloured starch using a *cheed/ baval* stick.

The shrine cloths are then dyed with alizarin, which reacts with alum to form a deep red. Alizarin is a yellow powder made from the root of madder plant, traditionally used as mordant dye. It produces jet black when applied to iron and a brilliant turkey red where an alum mordant has been used.

Dhawda flowers (200 gm) are added to this alizarin (200gms) bath once it reaches boiling point. This helps maintain the whitene

- ẃ

Ajanta Cave painting and use of natural colours

Ambarish Nandan
Visva-Bharati, Kala Bhavana, Santiniketan
&
Debashish Mahalanobish
Visva-Bharati, Kala Bhavana, Santiniketan

Abstract

Today's *Ajanta* Cave is a very famous site of tourist interest and which have been a world heritage site, since 1983. It dates from the 2nd century BC, which are decorated and ornamented with paintings and sculptures. These are considered as the masterpieces of fresco work of Indian art. The execution of this splendid magnificent work took place in two phases, beginning around 200 BC and completing around 600 CE in the canyons of river Waghora of Maharastra state. These huge works however were fortunate to get the proper and requisite patronage of many influential authorities, time to time. The numerous master artists and their followers were involved in this long time project and as a result of which the existence of *Ajanta* made possible. The history of *Ajanta* acknowledges us that it had been abundant and became a forgotten chapter for a long period, and once again opens its veil to the modern day light. In this paper, the caves which are enriched with fresco painting are taken for consideration where the scenes from the life of Lord Buddha, *Jataka* tales and decorative motifs —– geometric and of flora and fauna, both are found. The woven of fresco with lines and shade of colour pigments in *Ajanta* caves is the center of interest in this paper. The authors have made an attempt to high light the intelligent use of natural colours in composing the depicted figurers and motifs on the frescos and the colours which are available in neighboring areas, as well as from distant region.

***Keywords*:** *Ajanta*, Cave painting, Natural colour.

- -

Eco-friendly dyes of India

Padmini Tolat Balaram
D. J. Academy of Design, Coimbatore, India.
E-mail: pbalaram2003@yahoo.co.in

Abstract

- -

"In the history of world textiles, India was famous for its cotton and its painting, printing and dyeing techniques which yielded varieties of fast colours, while China for its silk production and brocades… Expertise of Indian chintz lay in its fast brilliant multi-coloured exotic patterns, and the quality of the cotton used to paint them, which made them popular all over the world for centuries. Starting from Mohenjodaro period, its demand and praise for its quality continued till 19th century CE, this is for about 6,000 years!" (Balaram, Movement of Textiles and Textile Motifs between India, China, Korea and Japan 2011, 9) As per Narain "Chintzes found in the tombs of the royal patrons of Egypt were nevertheless beautifully coloured and charming. Most of them have been found to be dyed with safflower and indigo which had surely gone from India, the natural home for the indigo plant. That is, at about 4000 B.C. India had been exporting dyestuffs to the countries called cradle of western civilisation." (6) The very fact that the colours of textiles that were found in excavations after several centuries still looked 'beautifully coloured and charming' says a lot about the fastness of the Indian dyes. Strabo the geographer has quoted Nearchos, the admiral of Alexander the Great sent in 327BCE to India "mentions the flower cottons or Chintzes of Indians, and also praises the various beautiful dyes with which their cloths were figured." (qtd. Baker 2). Pliny the Elder (70 CE) described the mordant dyeing process used in Egypt. His description clearly indicates that "the drug employed to stain the cloths were different mordants, which when dyed in a vat of one colour gave various colours on the same cloth from the one dyeing operation." (qtd. Baker 2) Baker comments "Calico printing (or painting) and dyeing therefore were known at this period to the Egyptians, having been doubtlessly acquired from India, and Pliny's writings are the bed-rock from which all knowledge of this nature are derived." (2). These statements confirm that India was expert in mordant dyeing technique, used for dyeing with natural dyes and had exported not only the textiles but also the natural dyes and its dyeing techniques! Japanese scholar Yoshioka Sachio's comment confirms this. He said in 1st century CE, when most of the countries were still at the cradle of civilisation, India had come to dye dull browns and grahiJ11.825 TD.l.655 7c.1.00

Are the colours dull when dyed using natural dyes?

Looking at the brightly coloured textile pieces found at Fustat, which are dated 9th century CE onwards, as well as the trade textiles preserved in all over the world in various museums and private collections, one can easily say that the natural dyes yielded beautiful rich colours. The misconception that natural dyes give dull colours is due to the textiles presently sold as natural dyed fabrics. Many of these present textiles are not dyed completely using natural dyes, for example most of them use alizarin which is manufactured using chemicals. The dyeing process is now shortened and water used is not always as clear as it used to be. These have resulted in dull and not fast colours.

The difference in colour created by using different dyeing methods could easily be understood from the experiment carried out by author at Tokushima in Japan in 1996. To dye silk red, cochineal dye was used along with alum mordant. One piece of silk fabric was dyed using Indian dyeing method while another using Japanese process. The dye, mordant, their quantities, dyeing temperature and duration were all maintained same for both the samples. The silk dyed using Indian method achieved deep and rich red, while the one dyed using Japanese method acquired light pink colour. Thus the brightness of colour is more due to the dyeing process. Hence a sweeping statement that natural dyes yield dull colours is not true.

Standardisation of natural dyes is impossible to meet the industries requirements

This statement raises questions whether natural dyes and manual batch production should try to imitate the quality of chemical dyes and large machine productions of the factories. Instead should it not be the virtue that each individual piece is slightly different than others? Certain amount of quality standardisations could easily be achieved. But there is no harm in having slight difference in colours in production of each batch; actually it makes the fabrics special. Manual production also gives employment and saves energy.

Are all natural dyes and natural dyed fabrics eco-friendly?

During a national conference on Natural Dyes, way back in 1980s, a proud industrialist announced, “Mine is the first industry in India which extracts natural dyes and exports them. Last year I extracted tons of red dye from *sapan*-wood.” He also complained that “prices of *sapan*-wood have gone up this year as last year he used up 1/5th of the *sapan* trees of India.” The statement shocked the author. If one industry in their greed to earn foreign exchange finishes 1/5th of the trees of a large country as India, what would happen if more industries are opened? Even the same industry had started feeling the shortage of raw material just within a year! This particular tree takes 50 years to grow into a mature tree. Finishing them in 5 years could be so devastating. On asking, “What actions are you taking to replenish the forest? Are you planting new saplings?’ The industrialist got very angry and said “It is the duty of the government, of the forest department, if he gets in to planting how *canhe* run his industry?” If we go about using natural dyes in this manner, we would rob the mother earth. The grab-all attitude would only increase the problem rather than solving it. Unless and until we see in totality, there could be no solution.

Nature — a store house of vegetable dyes

B.V.G. Prasad
Department of CIHAB
Institute of Agriculture, Visva-Bharati, Sriniketan, Birbhum, Wes Bengal,
E-mail: bvgprasad85@gmail.com.

Abstract

The art of making vegetable dyeing is one of the

Scope of application of Multi-Criteria Decision Making (MCDM) technique for selection of vegetable dye

Prabir Kumar Choudhuri
Visva-Bharati University, Department of Silpa-Sadana, Textile Section,
Sriniketan, Birbhum, West Bengal -731 236.

Abstract

Multi-criteria decision making is a branch of operation research (OR), now popularly used in the field of engineering, banking, fixing policy matters etc. It can also be applied for taking decisions in daily life like selecting a car for purchase, selecting bride or groom and many others. Various MCDM methods namely Weighted sum model (WSM), Weighted product model (WPM), Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solutions (TOPSIS) and Elimination and Choice Translating Reality (ELECTRE) are there to solve many decision making problems, each having its own limitations. However it is very difficult to decide which MCDM method is the best. MCDM methods are prospective quantitative approaches for solving decision problems involving finite number of alternatives and criteria. So the MCDM technique provides enough scope to be applied for the selection of vegetable dye or ranking the dyes among few ones keeping in view a particular object and on the basis of some selection criteria. The present

Overview of MCDM and AHP

Multiple criteria decision making (MCDM) is a very popular discipline of Operation Research (OR), having relatively short history of about 40 years. Its development has accelerated with the rapid development of computer technology. Computer programming has helped to handle huge data related to criteria, sub-criteria and alternatives, their systematic analysis to tackle MCDM problems, complex in nature. This has made MCDM extremely important and useful tools in solving business decision making problems.

For n criteria, the matrix will be $n \times n$ order. The entry c_{ij} will denote the comparative importance of i criteria with respect to j criteria. In the matrix $c_{ij} = 1$ when $i = j$ and $c_{ji} = \frac{1}{c_{ij}}$ .The pair-wise comparison matrix C_1 is shown as: $C_1 = \begin{matrix} 1 & c_{12} & ..... & c_{1n} \\ c_{21} & 1 & ..... & c_{2n} \\ ..... & ..... & 1 & ..... \\ c_{n1} & c_{n2} & ..... & 1 \end{matrix}$

The normalised weight of the *i-th* criteria (w_i) is determined by calculating the geometric mean of the *i-th* row (GM_i) of the above matrix and then normalising the geometric mean of rows. This can be represented as follows:

$GM_i = \{\prod_{j=1}^{n} c_{ij}\}^{\frac{1}{n}}$ and $W_i = \frac{GM_i}{\sum_{i=1}^{n} GM_i}$

The principal eigen vector (λ_{max}) of the above matrix of the original pair-wise comparison matrix (C_1) is calculated. To check the consistency in pair-wise comparison judgment, consistency index (CI) and consistency ratio (CR) are calculated by following equations:

$$CI = \frac{\lambda_{max} - n}{n-1} \quad \text{and,} \quad CR = \frac{CI}{RCI},$$

Where, *RCI* = random consistency index and its value can be obtained from table 2.3. If the value of CR is 0.1 or less, then the judgment is considered to be consistent and therefore acceptable. Otherwise the decision maker has to reconsider the entries pair-wise comparison matrix.

In order to calculate the relative importance of sub criteria with respect to corresponding criteria, the pair-wise comparison between the attributes of sub-criteria are made in the same way previously discussed. The global weights of sub-criteria are calculated by multiplying the relative weight of sub-criteria with respect to the corresponding criterion and the relative weight of criterion with respect to the objective.

Table 1: The fundamental relational scale for pair-wise comparisons proposed by Saaty [1]

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective.
3	Moderate importance of one over another	Experience and judgment slightly favour one activity over another.
5	Essential or strong importance	Experience and judgment strongly favour one activity over another
7	Very strong importance	An activity is strongly favoured and its dominance is demonstrated in practice.

ranking the cotton fibres which gave good agreement with the ranking of yarn in terms of tenacity.

Application of Miltiplicative AHP in section of vegetable dyes

Hierarchy formulation

The goal or objective of the present investigation is to determine the acceptance value of vegetable dyes which should reflect the achievable level of Fastness properties, availability and polygenetic properties. So, the dye properties criteria of this problem can be classified under three headings, namely fastness properties, cost and polygenetic properties. Fastness properties can be divided into three sub-criteria, washing fastness (WF), rubbing fastness (RF) and light fastness (LF) whereas cost criteria and polygenetic properties are solely represented by raw material cost (RMC) and no. of H c

Table 3: Pair-wise comparison matrix of criteria with respect to objective

Criteria	Fastness	Cost	Shade variation	Geometric Mean(GM)	Normalized GM
Fastness	1	7	5	3.271	0.731
Cost	1/7	1	1/3	0.362	0.081
Polygenetic properties	1/5	3	1	0.843	0.188

It can be inferred from table 3 that fastness properties very strongly predominate over the cost

- -

Table 4: Pair-wise comparison of sub-criteria with respect to fastness properties

Tensile properties	Washing fastness	Rubbing fastness	Light fastness	GM

DABU - A unique style of mud printing

Jasminder Kaur
Textile Section, Department of Painting, Faculty of Visual Arts
Banaras Hindu University. Varanasi

Abstract

Rajasthan is known for their eye-catching multicolor dressings, which are produced by unique dyeing and printing techniques with vegetable colours, mostly on cotton fabric. The present article deals with some of the oldest techniques of dyeing and printing. The art of printing was patronized by the Royals in Rajasthan. They played key role in the survival and development of printing and still there were many centers deprived of Royal patronage. These centers practiced the folk form of printing commonly known as “DABU”. It is one of the oldest printing techniques in India. And is the most popular and favoured printing of Rajasthan. *Dabu* is a resist print technique, which implies covering or impregnating of certain portions of the cloth, intended to be kept in the background colour. This covering is done with wax, clay, gum, resin or other resisting materials. Dabu was popular in all those centers of Rajasthan, where there was abundance of water. In Bagru near Jaipur, Barmer and kaladera near Udaipur, Jodhpur, Akola near Chittorgarh etc. this technique is practiced with few changes and modification in the material, ingredients, colour scheme and motifs. *Kalidar Dabu*, *dolidar dabu* and *gwar wali dabu*

Mein ki Dabu

Apart from *mitti dabu,* another technique called "*mein ki dabu*" – wax resist was also popular in Rajasthan. Cloths printed with this technique were used to give out a smell of perfume. For this, nearly two and a half kg of honeybee wax, 10kg of *chir* (pine) solution and an amount of *Tilli* oil mixed with small quantity of pure ghee was heated on a certain temperature. The solution obtained was stained directly in '*mardia'* (mud pot). Whenever there was a need, this solution was again heated to use. The impression of cracks is equal and clear in this *dabu* in comparison with *mitti dabu*, where the cracks are arbitrary and not in control. The process of taking off this *dabu* from the fabric is known as *Ukala*. The process is done by adding 5% of soda ash in hot water.

Role of ingredients

Application of *dabu* on fabric

Instead of printing the fabric with block, the dabu is spread with a brush, when original background colour of the fabric is not to be disturbed. *Dabu* process is sequencing of different stages of dyeing & printing, which vary depending on the desired final pattern.

The areas with *dabu* resist will not absorb colour on further dyeing. Saw dust is sprinkled over the surface, following the application of *dabu* to facilitate quick drying of the fabric. The saw dust also acts as a binder which prevents color penetration while dyeing. Dying with alizarin develops a rich red colour in areas printed with *begar* paste. The fabric is then washed & dried and if needed, printed again with *dabu* before immersing in *neel o*r indigo dye to produce a deep blue colour. Before executing another work of *dabu*, the cloth must be dried properly first; otherwise the colours will spill over on a wet ground. It is therefore, that *dabu* work is not done during the rainy season.

After the application of *dabu*, the cloth is dyed in blue. *neel* or indigo. The blue dye is frequently used in the region. It is extracted from the *neel* plant (indigofera tinctoria). For

- -

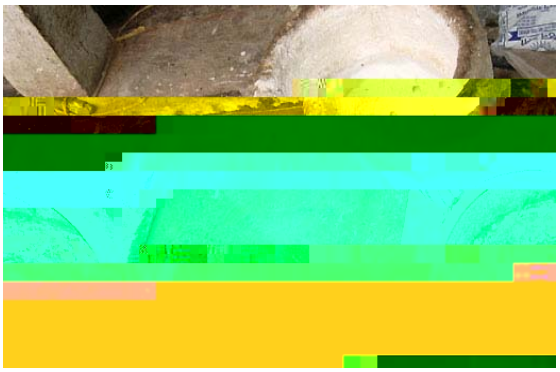
DABU Printed Cloths



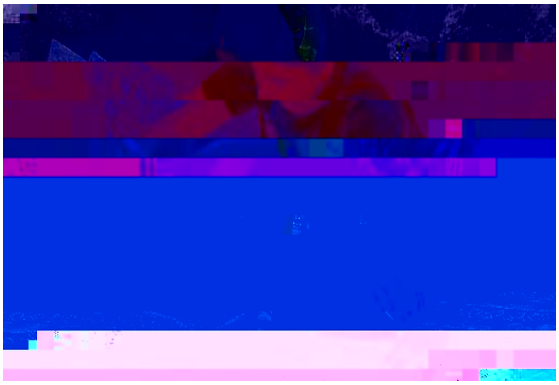



Variations of *DABU* Designs produced using with different mineral and vegetables dyes.

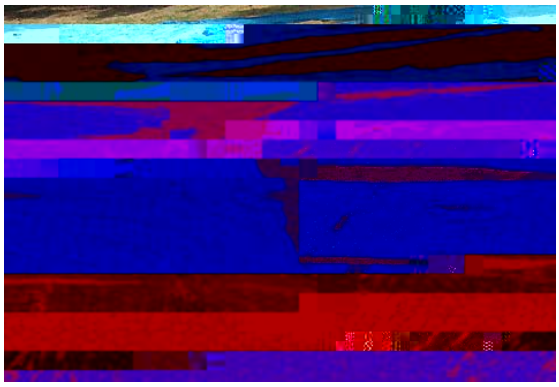
DABU Process




Preparation of *Dabu* Paste (mud *Dabu*)




Printing with Dabu & printed cloth

Indigo dyeing & sun dry of dye cloth after printing

Mordants and their hazards

Ashis Mitra
Visva-Bharati University, Department of Silpa-Sadana, Textile Section,
Sriniketan, Birbhum, West Bengal-731236,
E-mail: mitra.ashis1@gmail.com

Abstract

There is a popular opinion that 'natural' means completely safe and ecofriendly. Contrary to this opinion, natural dyes are often neither safer nor more ecologically sound than synthetic dyes. Life Cycle Assessment (LCA), which is a method to study the environmental aspects and potential impacts throughout the product's life (i.e. 'cradle-to-grave'), is essential before making any concrete comment regarding eco-friendliness of any product or process. Unmodified natural dyes, in general, may have a significantly lower environmental impact, however. This article reveals that most natural dyes are not particularly toxic in themselves, but they will not stick to textile fibres unless they are treated with a mordant. Mordants that are commonly used by "natural" dyers today are metal salts, which vary from slightly to deadly poisonous. Typically, a mordant is a heavy metal. Heavy metals are extremely toxic, and bad for the environment, as well. Amidst all the mordants employed for natural dyeing purposes, alum is relatively safe, and in the interest of sustainability and lower environmental impact, all others could be eliminated.

Keywords: Environmental impact, Heavy metals, Mordants, Natural dyes, Toxicity.

Introduction

Today, natural colourants that are safer and ecofriendly in nature [2] are emerging globally, leaving synthetic colourants behind in the race. These have been used for textiles for a long time. Natural dyes exhibit better biodegradability and are generally more compatible with the environment. In spite of their inferior fastness, natural dyes are more acceptable to environmentally conscious people around the world [3].

In response to the "green" movement and ecological campaigns, some dye manufacturers might be re-considering the feasibility of adopting natural dye in lieu of synthetic dye in dyeing process. Since the adoption of natural dyes may lead to the problems of poor dye uptake and low colour fastness, it is quite logical for them to introduce a traditional mordant to resolve the situation. In common practice, the traditional mordants adopted fall mainly within the group of heavy metal category. The heavy metals detached from these traditional mordants, however, will contaminate the water and poison the environment, thereby jeopardising the original intention of using environmentally friendly dye for better protection of the environment [3].

Contrary to popular opinion, natural dyes are often neither safer nor more ecologically sound than synthetic dyes. They are less permanent, more difficult to apply, wash out more easily, and often involve the use of highly toxic mordants. Some natural dyes, such as the

hematein derived from logwood, are themselves significantly poisonous. Of course, the color possibilities are far more limited; the color of any natural dye may be easily copied by mixing synthetic dyes, but many other colors are not easily obtained with natural dyes.

Copper (Copper Sulfate)

This mordant is used to bring out the greens in dyes. It will also darken the dye colors, similar to using tin, but is less harsh.

Chrome (Potassium Dichromate)

Chrome brightens the dye colors and is more commonly used with wool and mohair than with any other fiber.

Iron (Ferrous Sulfate)

It dulls and darkens the dye colours. Using too much of this mordant will make the fiber brittle.

Glaubersalt (Sodium Sulfate)

It is used during natural dyeing to level out the bath. It is also used in chemical dye.

Spectralite (Thiourea Dioxide)

This is a reducing agent for indigo dyeing.

Tara Powder (Caesalpinia Spinosa)

Tara Powder is a natural tannin product. It is needed for darker colors on cotton, linen and hemp.

Tartaric Acid

This is a must for cochineal. This mordant will expand the cochineal colors.

Tin (Stannous Chloride)

Tin will give extra bright colors to reds, oranges and yellows on protein fibers. Using too much will make wool and silk brittle. To avoid this, a pinch of tin can be added at the end of the dyeing time with fiber that was premordanted with alum. Tin is not commonly used with cellulosic fibers.

Calcium Carbonate

It is generally used with indigo powder for the Saxon blue color. It can also be used to lower the acidity of a dyebath.

Methods of applying mordants

There are three methods by which mordanting can be done:

Pre-mordanting (onchrome): The substrate is treated with the mordant and then dyed.

Meta-mordanting (metachrome): The mordant is added in the dye bath itself.
Post-mordanting (afterchrome): The dyed material is treated with a mordant.

The type of mordant used changes the shade obtained after dyeing and also affects the fastness property of the dye. The application of mordant, either pre-, meta- or post-mordant methods, is influenced by:

The action of the mordant on the substrate: if the mordant and dye methods are harsh

are not present, and if the material mordanted wi

to the compost, or fed to plants that require acidity in the soil. Cream of tartar, another food additive, can be used in conjunction with alum, to soften the wool (alum can cause fibers to become brittle). Copperas (Ferrous sulfate) is used to acidify soils. For most plants soil acidification is unnecessary, but lowering the soil pH is frequently required to grow plants such as blueberries, azaleas, and rhododendrons successfully [8]. Copperas powder can be used as an iron mordant, although it is not as safe as pickling alum. If copperas is used, it is better not to inhale the fumes,

Table 2: Textile mordants and health hazards [15]

Type of Mordant	Other Names	Ingestion hazards	Inhalation hazards	Skin Contact hazards	Other Hazards
Alum	Potassium Aluminum Sulfate, Ammonium Alum, Ammonium Aluminum Sulfate	Slightly toxic to moderately toxic	Slightly toxic	Slightly toxic	May cause irritation and allergies
Copper Sulfate	Blue Vitriol	Highly toxic; causes vomiting, irritation	Moderately toxic	Slightly toxic	May cause skin allergies, irritating to skin, eyes, nose, throat
Cream of Tartar	Potassium Acid Tartrate	Moderately toxic	Slightly toxic	Slightly toxic	Mildly irritating; fatalities have occurred from ingestion of large amounts
Ferrous Sulfate	Copperas	Moderately toxic	Slightly toxic	Slightly toxic	Soluble iron salts are slightly irritating to skin, eyes, nose, throat; can cause poisoning
Oxalic Acid		Highly toxic; severe corrosion	Highly toxic; severe respiratory irritation	Highly toxic; may cause corrosion	May cause shock, collapse, possible convulsions, death
Potassium Dichromate	Potassium bichromate, chrome	Extremely toxic	Extremely toxic	Highly toxic; corrosive	Probable carcinogen; can cause fire in contact w/reducing agents, solvents, organic materials
Stannous Chloride	Tin Chloride	Moderately toxic	Moderately toxic	Slightly toxic	Irritating to eyes, mucous membranes
Tannin	Tannic Acid	Moderately toxic	Slightly toxic	Slightly toxic	Possible carcinogen

Natural dye — an overview

Sankar Roy Maulik
Visva-Bharati University, Department of Silpa Sadana, Sriniketan – 731236
E-Mail: s_r_moulik@yahoo.co.in; (M) +91 9434326415

Abstract

One of the early classes of materials that man found to be useful for protective and other purposes is the fibre class of materials obtained from natural sources. All those fibres used by man from the early days are obtained from vegetables and animal sources. Prominent among them are cotton, flax, ramie, jute etc obtained from forests or by agro efforts and silk, wool and other kinds of animal hairs obtained from insects/animal kingdom. Affairs related to environmental preservation, control of pollution and use of energy efficient materials and processing have renewed interest for use of natural fibres. It is imperative that such natural fibres should be processed following related environmental requirements to have little/no adverse impact on the production ecology, user ecology and disposal ecology. Natural dyes or colourants obtained from renewable resources, such as, plants and animals have been receiving increasing attention in the recent times in view of its environment friendly character. Technologies associated with colouration of natural fibres with natural dyes have yet to pass through stages of refinements and sophistications to suit newer demand and to eliminate or to improve upon some known deficiencies or disadvantages and additionally, to infuse efficiency in processing, enhance durability of processed end use products and also to make them more acceptable, comfortable and attractive.

***Keywords*:** Cotton, Dyes, Mordants, Pigments, Silk.

Introduction

Natural dyes are the dyes and pigments obtained from renewable resources of nature, such as plant and animal, although natural dyes from minerals of the earth are also known [1]. Colouring matter derived from different organs of a plant, such as root, leaf, bark, trunk or fruit are known as vegetable dyes; while the colouring matter obtained from the animal kingdom such as lac, cochineal and kermes are known as animal dyes. Colouring matters obtained from various inorganic metal ores and metal salts are known as mineral dyes [1, 2]. Natural dyes find application chiefly for colouration of food, drugs, cosmetics and textile. Some quantities of dyes are also used for colouration of paper, leather, shoe-polish, candle, wood etc [3].

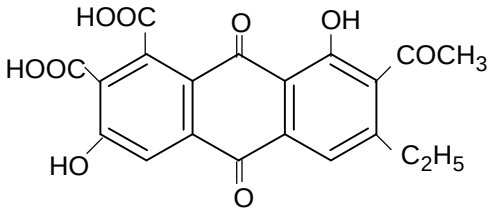
Use of natural dyes for colouration of textile is practiced since early days [4]. After the synthesis of Mauveine by William Henry Perkin [4] and its subsequent commercialization, the use of natural dyes receded and the position continued to be much the same until in the recent past growing consciousness about environmental preservation and control of pollution and conventional wisdom and belief regarding environment friendliness of natural dyes have renewed interest for use of natural dyes for the colouration of textile [2, 5-7].

The advantages and major attractions of natural dyes are as follows:

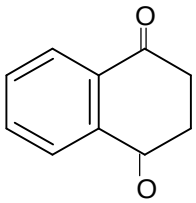
They are obtained from renewable resources
They pose no health hazards
Their extraction involves mild or no chemical reactions
They pose no disposal problem
They are harmonized with nature
They offers soft, soothing and uncommon shades
Locally available plants and vegetable waste can be used as natural dyes
Use of natural dye is a labour intensive process; thereby it provides job opportunity for all those engaged in cultivation, extraction and textile application.

However, the inherent drawbacks of the natural dyes and its applications are:

Ability to dye chiefly natural fibres
It is difficult to standardize the recipe and methods for the use of natural dyes
Most of the natural dyes with a few exception require the use of mordant to fix them on to the fibre
The aqueous extract of natural dyes causes fungi growth if not used within 24 - 48 hours. Preservation of the aqueous extract of natural dye is very essential in order to store the dyestuffs for a longer time without affecting the colour strength.
Lack of availability of standardized methods and precise technical know-how on extraction and dyeing technique for application of natural dye.
Application of natural dyes are sometime



(ii) Laccaic acid (Lac dye)



Natural dyes were initially classified into two groups, such as substantive and adjective dyes [1]. Substantive dyes were those, which appear to have affinity for the substrate and adjective dyes were those, colouration with which could be accomplished only in presence of one or any two from the following: metal salts, tannins or tannic acid and oil. Such compounds that create affinity of natural dye for the fibre are known as mordant. Among the

be directly used for the dyeing purpose. This solution can also be diluted to different concentrations for producing different shade depth.

Procedure of Dyeing

Cotton Yarn

Before dyeing, the cotton yarn/fabric should be properly scoured and bleached to remove all the added and natural impurities. Mercerized yarn will produce better effect in respect to colour yield or depth of shade. Bleaching should be done with hydrogen peroxide, hypochlorite beaching is not preferred. After scouring and bleaching the yarn must be properly washed and then taken for dyeing.

Silk Yarn

In case of silk yarn/fabric, it must be pr

90^0C for 20-30 minutes. For both mordanting and dyeing operations the material to liquor ratio is maintained at 1:15 to 1:20. Soaping of the dyed yarn should be done employing 1-2 g/l non-ionic detergent at 50^0C for 5 – 10 minutes.

The following precautions should be taken while using natural dyes for the coloration of textile materials:

Metal salts should be used in such nearest possible quantity to avoid wastages and to minimize sewage pollution as well as not to exceed the limit of eco-parameters for textiles or not to be included in the list of objectionable heavy metal.

The final dyed materials should always be washed with non-ionic liquid detergent to remove the surface colours and to improve wet fastness properties. Ordinary soap or detergent available in the markets should not be used as it contains sodium compound, which may cause severe change in tone of the final shade.

Water used for extraction should be free from metallic impurities and hardness of around 50 ppm is recommended.

The aqueous extraction with alkali is the most common methods, but these may change the actual tone or hue of the actual colour. So it is always better to extract the dyes with water.

Reference

1. *Natural Dyes and Their Application to Textiles*, Ed. M L Gulrajani and D B Gupta (Indian Institute of Technology, New Delhi), 1992.
2. J D Hill, *Rev Prog Col*, 27 (1997), p19.
3. M L Gulrajani, *Indian J Fibre Text. Res*, 26 (3&4), (2001), p191.
4. E R Trotman, *Dyeing and Chemical Technology of Textile Fibres*, 1st edn, (B I Publications Pvt. Ltd., New Delhi), 1994.
5. B Glover, *Textile Chemist Col*, 27(4), (1995), p17.
6. T Dheeraj, T Priyanka and M Monica, *Colourage*, 50(7), (2003), p35.
7. E M Dedhia, *Colourage*, 45(3), (1998), p45
8. R A Lal, *Colourage*, 42(1), (1995), pp55-56.
9. S R Shukla, *Colourage*, 53(8), (2006), p75.
10. M L Gulrajani, *Colourage*, 46(7), (1999), pp19-28.
11. V K Mishra, *Colourage*, 46(7), (1999), p31.
12. N Sekar, *Colourage*, 46(7), (1999), pp33-34.