APPLICATION OF NATURAL DYES ON TEXTILES PRODUCING FROM SOME PLANTS

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Abstract

Natural dyes are one of the most important sources derived from plants, invertebrates or minerals. These dyes are eco-friendly in nature. Research has shown that synthetic dyes are more suspected to release harmful chemicals that are allergenic and carcinogenic in nature and also affects human health. Nature has blessed us with many valuable varieties of dye yielding plants. In this study altogether 10 resources plants were subjected in the extraction of plant dyes by simple and easy method of Seiju Yamazaki (2000). The quality of dyes is practically used in the dyeing of cloths with the help of 5 different mordants such as Alum, $CuSO_4$, Tamarind, Camella and Vinegar. To extract desirable colour, the plant parts such as fresh leaves, flowers, fruits, barks and rhizomes were used. The outstanding features, the colour of cloths and taxonomic description of dye-yielding plants are discussed in this study.

Introduction

The plant kingdom is a treasure house of natural products. In the human civilization plants are used not only for the basic needs of life such as food, fiber, clothes and shelter but also as sources of natural dyes for dyeing cloths, design and paintings. Plants have traditionally been utilized as a sources of colorants for dyeing mats, ropes and other home based materials for a long time. These plants are a potential source of natural dyes. In recent years there has been an increasing awareness about the use of natural products, since they do not have any side effect. One such product from nature is dye. The major it's of natural dyes are from plant sources namely; leaves, flowers, fruits, berries, seed, barks, roots, woods and other organic sources such as fungi and lichens. (Ferreira *et al.,* 2004).

Dyes can be defined as highly colored subs-tances that can be used to impart color to an infinite variety of materials like textiles, paper, wood, varnishes, leather, ink, food, cosmetics, medicine, toothpaste, etc. Dyes of natural origins are great for color appreciation as any variation in the concentration of dye, mordant type of water, soil and climate give variations in color. The term dye includes natural dyes, synthetic dyes, pigments and whiteners. Natural dyes can be stored into three categories; natural dyes obtained from plants animals and minerals. Although some fabrics such as silk and wool can be colored simply be being dipped in the dye, other such as cotton require a mordant.

Most natural dyes need chemical species called mordants for binding the dye to fabrics to improve color fastness, and to prevent the color from either fading with exposure to light or washing out. Mordants help in binding of dyes to fabric by forming a chemical bridge from dye o fabric thus improving the staining ability of a dye with increasing its fastness properties (Padma, 2000). The color fastness and characteristics of natural dyes on fabrics are influenced by the mordanting method applied whose effects vary with the source o the dye. A mordant is an element which aids chemical reaction that takes place between the dye and the fiber, so that the dye is absorbed. Containers use for dying must be non-reactive (enamel, stainless steel). Brass, copper or Iron pots will do their own mordanting.

The flowering plants play a major role of our daily life with the variety of color especially in clothing, eatable and in shelters. Plants dominative as sources of natural dye some do not dissolve in water, some cannot be adsorbed onto fibers. Other dyes many fade when,

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washed or exposed to air or sunlight (siva, 2007). Myanmar people have very few knowledge of plant dyes and their effect on our health, or our socio economic status. Some greedy merchant men put the dangerous synthetic dye into the tea leaves and tea pickles which are major traditional food in Myanmar.

Nearly 450 plants are known to yield dyes (Chandramouli, 1995), of which so are considered to be the most important. These plant are able to produce different colours like, Red, Yellow, Blue, and Brown, etc.

Natural dyes have several important advantages tan synthetic dyes. There are non-car-(inogenic, non-poisonous, les pollutant and less health hazardous. Moreover, the wast formed while using these dyes becomes an ideal fertilizer.

Natural dyes are automatically harmonizing colour. They produce rare colour ideas. They are gentle, soft and subtle and create a restful effect. Therefore, important to document, study and conserve these dye yielding plant. Hence this study was initiated to survey, collect, identify and document the dye yielding plants. Aims and Objectives are to know about natural dyes and pigments and to share the knowledge of information and distribute on the useful plants. To promote the use of natural, substantially materials in the creation of arts and crafts and to protect and maintain biological sources and stud the technical possibilities to contemporary textile production.Mainly aim to substitute the chemical mordant instead of plant natural parts used for mordant and to understand the concepts of natural dyes and dye yielding plants.

Materials and Methods

Compounds used for dyeing are dye-stuffs. Natural dyestuffs and stains are obtained mainly from plants, minerals and even from animals. The majority of natural dyes are vegetable dyes from plant resources. The plants to be used as dyes differ according to the plants. In this study, Dyes are extracted from different parts of the plant body like, root, bark, leaves, flowers, fruits, seeds, worlds and bulbs.The respective plant parts were taken freshly and subjected to dyes extraction methods.

Identification of Resource plants

The botanical study of dye resource plants were performed in Department of Botany, Yenanchaung Degree College with the help of literature such as Cronquist, Dassanayake, Hooker. The outstanding features of collected resource plants were matched with the herbarium specimens and cited literatures and identified into genus and species.

Dye were extracted from fresh parts of different plant by aqueous methods as simple and easy method of Seiju Yamazaki (2000). The plant parts are recommended to obtain the best color results and should be used immediately after they are gathered. The plant parts of Dye materials such as leaves, flowers, fruits, barks, roots, rhizome, etc are chopped into fine bits, place in a pot and boiled. After boiling for 30 minutes, the extract is strained. The dyematerials are again put in a pot, water is added and then further boiled to obtain the second extract. In the case of plant parts, dye materials are boiled to obtain the extract as follow;

(a) in the case of leaves, the plant materials are boiled two times,
(b) For flowers, barks, four times,
(c) roots and rhizomes, six time.

When the extract is obtained, it is passed through a cloth water filter to remove foreign matter. This method was undertaken to extract natural colour. The basic object is to obtain a concentrated extract. However, depending on plant materials used the boiling process can be decreased or increased.

Equipments

Equipments for the extraction of plant dyes and pigments are simple and easily accessible kitchen wares such as rice cooker, steel containers, which are used in boiling of plant parts or dye materials and to use for mordant bath. Other implement are 400ml pyrex glass beaker, cloth water filter, glass rods and simple laboratory utensils.

Cloth Dyeing and Fastness Color

Many natural dyes require the aids of mordants to bind the dye to the textile fibers. The standard mordant amount depends on weight of the cloth in the case of camella, Tamarind, Vinegar (Acetic acid), (CH_3COOH), Alum Al (CH_3COOH_3), Copper Sulphate ($CUSO_4$) and natural extracted color as control. The amount of mordant is dissolved in water to make a mordant bath. (Table 2).

The thread (cloth) is boiled in the dye liquid for 30 minute. Then it is left to cool and wash with water and then threated in a mordant bath for 30 minutes and washed with water. The dye liquid is again heated, the mordant threated cloth is left in this liquid until it cools. The cloth is taken out and washed with water several times, each time with fresh water. After washing, the cloth is left to dry in the shade where there is ventilation. This is repeated several time until the desired color is obtained. Size of plain cloth used of dying.

Pieces of plain woven cotton fabrics or size of crude cotton cloth with dimension of (10x15cm) each with an average weight of 2g were used in the dying.

Results and Discussions

Dyes are defined as intense substance use for coloration. There are two kinds of dyes, such as natural dyes and synthetic dyes. The content or amount of dye present in the plants varies greatly depending on the season as well as age of the plants. There are also several factors which influence the content of dye in each dye yielding plants. Two main types of dye extraction are; Alcoholic extraction and Aqueous, extraction.

In this present work, Aqueous extraction of dye was carried out for natural dyestuff. To determine the color fastness of the dye without application of any mordant was a control experiment. The color variation were with respect to the mordants used and variations in shades were due to mordanting experiments. (Table-4).

1. Scientific Name - *Clitoriaternatea*L. (Fig. 1)
   Myanmar Name - Aung-mae-nyo
   Family - Fabaceae (Papilionace)
   Part used - Petals

Outstanding Features

Twining herbs with young pubescent twigs, alternate, unipinnately compound leaves.bearing 5-7 elliptic leaflets, imparipinate, stipulate, pulvinate. Inflorescence axillary uniflorous cymes.Dark blue flower bisecual, zygomorpic, pentamerous, hypogynous, with foliaceous bracteoles, tubular, corolla papilionaceous; 10 diadelphous stamens; ovary supervior, unilocular with many ovules on the marginal placentae, the long style. Fruit oblongoid pods.

2. Scientific Name - *Terminaliacatappa*(Fig. 2)
   Myanmar Name - Bar-dan
   Family - Combretaceae
   Part used - Leaves

Outstanding Features

Large tree, woody, erect, branched. Densely clustered at the ends of branchlets, leaves simple, sessile, ovate, 2 glands present at the base of leaf reticulate venation. Pentamerous, regular, actinomorphic, polygamo-dioecious white.Calyx-tube apically campanulate and

tubular (adnate to ovary) at base.Petals absent. Stamens 5+5, exerted the upper 5 stamens alternate with calyx-labes, the 5 villous, stamens bent in wards in the bud; anther dithecous, introse, dehiscing by longitudianal slits. 2-5 carpellary, syncarpous, ovary inferior, ovary is unilocular with 2 or 3 anatropous ovules, stigma simple, filiform. Drupe is ovoid/ellipsoid, smooth, slightly compressed, red when ripe, 2-ridged when dry, glabrous, seed 1 inside the drupe. Seed non-eridospermic, cotyledons are convolute.

3. Scientific Name - *Cocosnucifera*L. (Fig. 3)
   Myanmar Name - Ohn
   Family - Palmae (Arecaceae)
   Part used - Skull (coconut shell)

Outstanding Features

Perennial tall, woody unbranched stem, fibrous.The large pinnate leave bone in a duster at the tip of the stem, feather-palm type.Inflorescence axillary, a large compound spadix. Flowers unisexual, the upper male flower, the lower female flower, actinomorphic, hypogynous, monoecius, antherdithecious, filament short, carpels superior, style short. Fruit fibrous drupe, three round scars on the hard endocarp, ovate or subgloboid. Seed rounded, solid and liquid endosperm.

4. Scientific Name - *Vitissetosa/ Vitisvinifera*L. (Fig. 4)
   Myanmar Name - Sa-pyit
   Family - Vitaceae
   Part used - Pericarp

Outstanding Features

Tendril-climbing vine.Weak,sympodium climbing by leaf-apposed, simple or branched tendrils which represent modified scorpioid shoots. Leaf simple, alternate, palmate, multicostate-reticulate. Flower small, yellowish-green, regular, bisexual, pentamerous, hypogynous. Sepals 5 gamosepalous, cup-shaped.Patals 5, petals cohering at their tips, and falling off as a cap-staemens 5, antipetalous, free. Bicarpellary, Syncarpous, ovary bilocular, each locule with 2 ovules, style thick, stigma circular, flat.Fruit Globose, succulent berry, containing 1-4 seeds.Seed small with thick testa, endosperm oily.

5. Scientific Name - *Lawsoniainermis*L. (Fig. 5)
   Myanmar Name - Dan-gyi
   Family - Lythraceae
   Part used - Leaves

Outstanding Features

Glabrous shrub or small tree, spine present.Leaves oblong to oblanceolate.Flowers sweet-scented, buds sometimes reddish at the apex; calyx tube long, corolla white, green or yellow.Fruits purplish green.

6. Scientific Name - *Chukrasiatabularis*(Fig. 6)
   Myanmar Name - Yin-ma
   Family - Meliaceae
   Part used - Barks

Outstanding Features

A large tree, woody branched stem leaves compound, imparipinnate, alternate. Inflorescence axillary panicle.Flowers actinomorphic, bisexual, complete, pedicellate, hypogynous.Sepals 5.gamosepalous, valvate aestivation, light green. Petals 5, polypetalous, imbricate aestivation, white. Stamens usually 10, monadelphous, antherdithecous, introrse.Tricarpellary, syncarpous, ovary superviortrilocularwith two ovule in each locule; axile placentation, styple simple, stigma trifid. Drupaceous fruit with one seed.

7.	Scientific Name	-	*Curcuma longa*Linn. (Fig.7)
	Myanmar Name	-	Sa-nwin, Na-nwin
	Family	-	Zingiberaceae
	Part used	-	Rhizome

Outstanding Features

Perennial herbs, tuberous rhizomes. Leaves alternate and distichous, blades broadly lanceolate, acute to accuminate at the tips. Inflorescence terminal dense spikes, bracts numerous, unequal in size and shape.Flowers bisexual, conspicuous two or three lobed lip (labellum), sessile.Perianth 6, distinct calyx and corolla, calyx white, corolla tube funnel-shaped.Stamen 1, staminodespetaloid. Ovary trilocular, style filiform, stigma 2 lipped.

8.	Scientific Name	-	*Mangiferaindica* Linn. (Fig.8)
	Myanmar Name	-	Tha-yet
	Family	-	Anacardiaceae
	Part used	-	Barks

Outstanding Features

Perennial evergreen tree, stems woody. Leaves alternate, simple leather, blades elliptic to oblong, cuneate at the base, acute at the apex, petioles pulvinate. Inflorescence terminal, paniculate cymes. Flowers are bisexual, polygamyous. Calyx 3, free.Corolla 5, free.Stamens 5, 1-functional, 4 staminodes, antherdithecous.Ovary globoid, superior, unilocular with one ovule in each locule on the axile placenta.

9.	Scientific Name	-	*Azadirachtaindica*Juss. (Fig. 9)
	Family	-	Meliaceae
	Local Name	-	Ta-mar
	Common Name	-	Margosa tree, Neem
	Part used	-	Barks

Outstanding Features

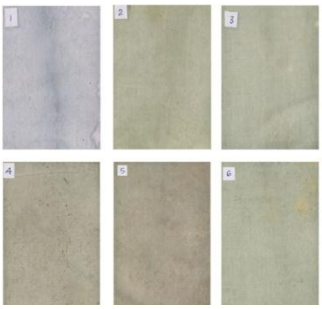
Perennial tree.Leaves unipinnatelyimparipinnate compound, alternate, exstipulate, petiolate, reticulate venation.Inflorescence terminal and axillary panicles raceme. Flower bisexual, regular, actinomorphic, cyclic, pentamerous, hypogynous. Sepals, synsepalous, valvate, sepaloid, inferior.Petals 5, apopetalous, petaloid, white, inferior. Stamens 10, monadelphous, inserted, anther dithecous, introrse, basifixed, inferior, Bicarpellary, syncarpous, bilocular, axile placentation, style simple, stigma capitate, ovary superior.

10.	Scientific Name	-	*Antigononleptopus*HK. &Arn. (Fig.10)
	Myanmar Name	-	Tike-pan
	English Name	-	Coralvine
	Family	-	Polygonaceae
	Part used	-	Flowers

Outstanding Features

A perennial climbing herb. Climbing stem, climbs by tendrils which represent modified branches, hairy, solid, cylindrical, weak. Simple, caulinepetiolate, stipulate, alternate, cordate, entire and acute, unicostate, reticulate venation. Short cymes of three flowers arranged on long axillary. Bracteate, pedicel hairy and pink, complete, bisexual, actinomorphic, hypogynous, pink.Tepals, 5, polyphyllous, petaloid, pink, quincuncial aestivation.Tricarpellary, syncarpous, ovary superior, unilocular with a single ovule, placentation basal, a nectar is located below ovary, styles 3; stigma 3, capitate. Single seeded nut.

Fig 1.*Clitoriaternatea* L.

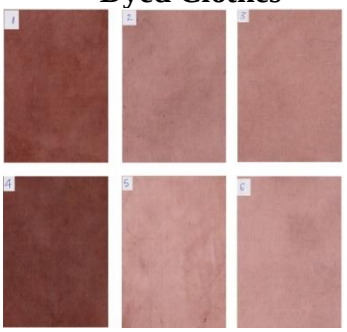


Dyed Clothes

Fig 2.*Terminaliacatappa*L.

Dyed Clothes

Fig 3.*Cocosnucifera* L.



Dyed Clothes

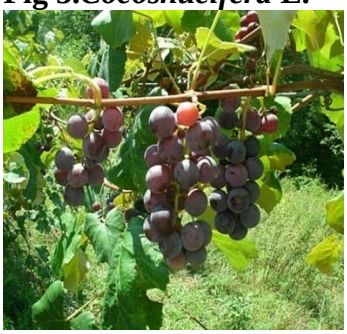
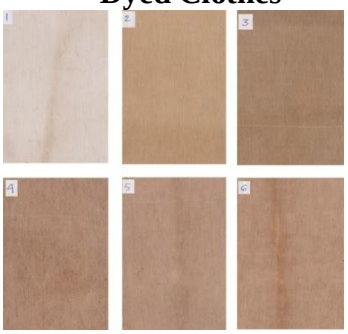
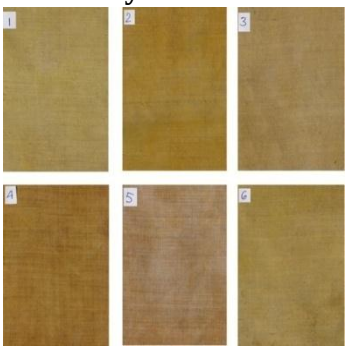


Fig 4.*Vitisvinifera*



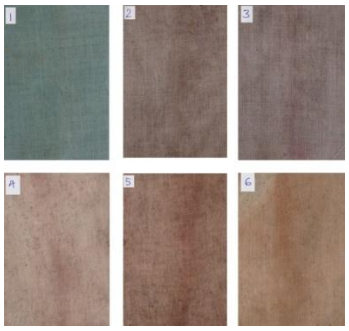
Dyed

Fig 5.*Lawsoniainmeris*L.



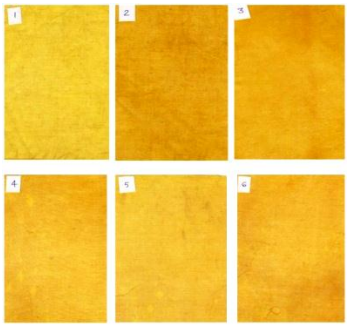
Dyed Clothes

Fig 6.*Chukrasiatabularis*



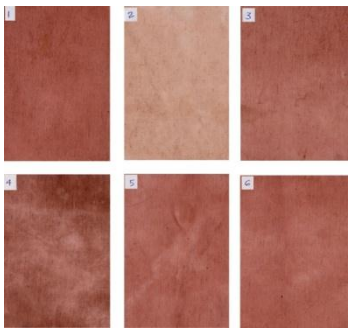
Dyed Clothes

Fig7. *Curcuma longa* Linn.



Dyed Clothes

Fig 8.*Mangiferaindica* Linn.



Dyed Clothes

Fig 9.*Azadirachtaindica*Juss.

Dyed Clothes

Fig 10.*ClerodendrumthomsonaeBalf.*

Dyed Clothes

Table. 1 List of Resource plants used in the Present Study

No	Scientific Name	Myanmar Name	English Name	Family
1	*Clitoriaternatea*L.	Aung-mae-nyo	Butterfly pea	Fabaceae (Papilionaceae)
2	*Terminaliacatappa*	Bar-dan	Almond	Combretaceae
3	*Cocosnucifera*L.	Ohn	Coconut palm	Palmae (Arecaceae)
4	*Vitissetosa/V vinifera*L.	Sa-pyit	Grape vine	Vitaceae
5	*Lawsoniainermis*L.	Dan-gyi	Henna	Lythraceae
6	*Chukrasiatabularis*	Yin-mar		Meliaceae
7	*Curcuma longa* L.	Sa-nwin	Turmeric	Zingiberaceae
8	*Mangiferaindica* L.	Tha-yet	Mango	Anacardiaceae
9	*Azadirachtaindica*Juss.	Ta-ma	Neem, Margosa tree	Meliaceae
10	*Clerodendrumthomsonae*Balf.	Taik-pan	Coralvine	Verbenaceae

Table .2 List of mordant and their concentration used in the present study

No	Name of mordant	Concentration
1	Alum	5 %
2	Copper sulphate	5 %
3	Tamarind	5 %
4	Camella	5 %
5	Vinegar	10 %

Table.3 List of plant parts and experimental criteria for the extraction of crude dye from the resource plants

No	Scientific Name	Part used	Frequency of Extraction
1	*Clitoriaternatea*L.	Petals	4
2	*Terminaliacatappa*	Leaves	2
3	*Cocosnucifera*L.	Skull (coconut shell)	4
4	*Vitissetosa/V vinifera*L.	Pericarp	4
5	*Lawsoniainermis*L.	Leaves	2
6	*Chukrasiatabularis*	Barks	4
7	*Curcuma longa* L.	Rhizome	6
8	*Mangiferaindica* L.	Barks	4
9	*Azadirachtaindica*Juss.	Barks	4
10	*Clerodendrumthomsonae*Balf.	Flowers	4

Table. 4 Nature of dyed cloth depending on the different mordant

No	Myanmar name	Scientific name	Part use	Control	Observed color depending on the mordant				
					Alum	Copper Sulphate	Tamarind	Camella	Vinegar
1	Aung-mae-nyo	*Clitoriaternatea*L.	Petals	Silver (gray)	Camouflage Green (green)	Alice Blue (blue)	Silver (gray)	Ecru (brown)	Silver (gray)
2	Bar-dan	*Terminaliacatappa*	Leaves	Flax (yellow)	Navajo White (yellow)	Pear (yellow)	Old gold (yellow)	Pear (green)	Navajo White (yellow)
3	Ohn	*Cocosnucifera*L.	Skull (coconut shell)	Auburn (brown)	Raw-umber (brown)	Russet (brown)	Auburn (brown)	Raw-umber (brown)	Rust (brown)
4	Sa-pyit	*Vitissetosa/ V vinifera*L.	Pericarp	Moroon (red)	Buff (brown)	Tan (brown)	Dare-tan (brown)	Pale Pink (pink)	Marron (red)
5	Dan-gyi	*Lawsoniainermis*L.	Leaves	Dark-goldenrod (yellow)	Pale Brown (orange)	Pale Brown (orange)	Fallow (brown)	Raw-umber (brown)	Dark-goldenrod (yellow)
6	Yin-mar	*Chukrasiatabularis*	Barks	Tea Green (green)	Pale Brown (brown)	Raw-umber (brown)	Khaki (brown)	Dark-tan (brown)	Horse's manure (brown)
7	Sa-nwin	*Curcuma longa* L.	Rhizome	Pale Yellow (yellow)	Amber (yellow)	Lemon (yellow)	Tangerine Yellow (yellow)	Golden (yellow)	Golden (yellow)
8	Tha-yet	*Mangiferaindica* L.	Barks	Brick (red)	Auburn (brown)	Russet (red)	Rust (brown)	Auburn (brown)	Auburn (brown)
9	Ta-ma	*Azadirachtaindica*Juss.	Barks	Raw-umber (brown)	Auburn (brown)	Auburn (brown)	Rust (brown)	Raw-umber (brown)	Raw-umber (brown)
10	Taik-pan	*Clerodendrum thomsonae* Balf.	Flowers	Beige (brown)	Beige (yellow)	Ecru (brown)	Ecru (brown)	Beige (brown)	Puce (red)

Conclusion

In this study, extraction in flowers of Taik-pan was used for dye production. Barks of Yin-mar, Tha-yet, Tamar and leaves of Dan-gyi, Bar-dan were also used. Besides pericarp of Sa-pyit, rhizome of sa-nwin and shell of Ohn were also used.

Almost all parts of the plants like heartwood, bark, leaf, flowers, fruit, etc produce dyes. It is interesting to note that the crude extract of Turmeric shown yellow colour dye to the test cloth (control), when the mordant was change to Alum, $CuSO_4$, Tamarind,, Camella and Vinegar, the colour contain the same as control. So the Turmeric is through to be substantive dyes, need no mordant to fix the color to the cloth fibers. Different mordant will give different colors from the same dye was shown in table.4. In this study, there are 8 different types of colors are obtained. They are yellow, red, blue, orange, pink, gray, brown and white. Yellow is the color of light. Gray is the achromatic color between black and white. Brown clors are dark shades of red, orange and yellow. Orange is the color between red and yellow. Blue is a color, the perception of which is evoked by light. Red is any of a number of similar colors evoked by light. Pink is a tint of red created by adding white. Shade of white is the combination of all the colors of the invisible light spectrum. It is often considered an achromatic color; green, blue and red are addative primary colors and yellow is subtractive primary colors.Alum and $CuSO_4$mordants usually given the best results, as it is cheap, very reliable and give bright colors.In this research, used the crude plant parts such as Camella and Tamarind as natural mordants, $CuSO_4$, Alum and Vinegar as chemical mordants.

Natural dyes are toxic, less polltuing, less health hazardous, non-carcinogenic and non-poisonous. Natural dyes are harmonizing colors, gentle, soft and subtle and

create a restful effect. One of the primary advantages of pigment dyeing is its ability to adhere to a wide range of textiles not just natural fabrics. Pigment dyed (garments) tend to be less colorfast, since the pigment dye is a layer on the surface of a textile. As a result, the dye will start to fade much more quickly. Natural dyes are environmental friendly and can be recycled after use. Although the Yenanchaung Township possesses large plant resources, only little has been exploited so far. More detail studies and scientific investigations are needed to assess the real potential and availability of natural dye-yielding resources. The modern techniques are required to improve the quality and quantity of dye production.

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