EXTRACTION OF NATURAL DYES FROM SOME DYE PRODUCING PLANTS

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Abstract

Dyes are one of the most important uses of the plants. The different parts of plants were used to extract natural dyes by using pre-mordanting method. Not only chemical (alum, copper II sulphate, quick lime) but also natural mordants (tamarind, inegar, Myanmar Green Tea Leaves) were used for fixing the color on the 14 x 3 cm and 1.15 g of wool. The resulted pH value and color formation pattern were recorded after mordanting.

Keywords : Chemical, natural, dye, mordant

INTRODUCTION

Myanmar has a rich biodiversity and plant kingdom is a treasure-house of diverse natural products. One such product from nature is the dye. Dyes are defined as colored substance that can be fixed firmly to a material to be dyed. Various plant parts including roots, leaves, twigs, stems, heartwood, barks, wood, taproots, flowers and fruits are the most preferred for production of the dye. Some parts may have more than one color depending upon which part of the plants is used. The shade of color, a plant produces will vary according to season at which the plant is picked, how it was grown, soil condition, etc (Hendery, 1995). The aims and objectives of the present research work are to collect the dye yielding species in study area, to know the processes of the extraction of dye from wild species and to study different types of mordant give different color tone.

MATERIALS AND METHODS

In this study, dye were extracted from the different parts such as fresh barks, leaves, flowers, rhizome and fruits by using the method of Seiju Yama zaki (2000) with some modifications. These raw materials were chopped into small pieces and boiled with distilled water (6000 mL) about 60 minutes. The solution was tested with litmus paper and recorded the value of pH. According to the post –mordanting technique, a piece of wool (14 x 3 cm and 1.15 g) was dipped in the dyebath with chemical and natural mordant for 30 and 45 minutes respectively. Then air-dry in shade was observed color formation.

Table (1) List of dye producing species in study area

No	Scientific name	Myanmar Name	English Name	Family	Part used
1.	Artocarpus heterophyllus L.	Pein-ne	Jack-fruit	Moracea	Barks
2.	Brassica oleraceae L	Ka-yan-gaw-phe	Purple cabbage	Brassicaceae	Leaves
3.	Butea monosperma L.	Pauk-pin	Bastard teak	Fabaceae	Flowers
4.	Cucumis longa L.	Na-nwin	Tumeric	Zingiberacea	Rhizomes
5.	Hylocereus undatus (Haworth) Britton & Rose	Na-gar-mout	Dragon fruit	Cactaceae	Fruits

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Table (2) Preparation for extraction of dye from some resources plants

No.	Myanmar Name	Part used	Weight (g)	Volume of water liter (ml)	Duration of Boiling time (min)	Frequency of swimmwer	Treatment
1	Pein-ne	Bark	600	6000	45 min	2	Cut into pieces
2	Ka-yan-gaw-phe	Leaves	600	6000	30 min	1	Cut into pieces
3	Pauk -pin	Flower	600	6000	30 min	1	Cut into pieces
4	Na-nwin	Rhizome	600	6000	30 min	1	Struck into pieces
5	Na-garmout	Fruit	600	6000	30 min	1	Peel into pieces

RESULTS

Scientific Name - *Arotocarpus heterophyllus* L.
Myanmar Name - Pein-ne
English Name - Jackfruit
Family - Moraceae
Part used - Bark

Habit

Part used

Figure (2) Habit and Part used of *Arotocarpus heterophyllus* L.

Distinct character

Perennial, monoecious, every green trees. Leaves alternately arranged, elliptical, often lobed on young trees but entire on mature trees. Inflorescence commonly borne on thick branches or the trunk of the tree. Fruit huge.

Table (3) Color formation of Tumeric treated with different concentration of different mordant

(Chemical mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	3	30 min	-	Yellow
T_1	2	30 min	Alum (1 g)	Pale yellow
T_2	2		Alum (2 g)	Pale yellow
T_3	4		Alum (3 g)	Dark yellow
T_4	2		Copper II sulfate (1 g)	Pale green
T_5	2		Copper II sulfate (2 g)	Bright green
T_6	4		Copper II sulfate (3 g)	Yellowish green
T_7	2		Quick lime (1 g)	Pale yellow
T_8	2		Quick lime (2 g)	Bright yellow
T_9	4		Quick lime (3 g)	Bright yellow

Table (4) Color formation of Tumeric treated with different concentration of different mordant

(Natural mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	3	45 min	-	Yellow
T_1	1	45 min	Tamarind (2 ml)	Pale brown
T_2	2		Tamarind (4 ml)	Pale brown
T_3	4		Tamarind (6 ml)	Brown
T_4	1		Vinegar(2 ml)	Pale yellow
T_5	2		Vinegar (4 ml)	Pale yellow
T_6	4		Vinegar(6 ml)	Pale yellow
T_7	1		Myanmar Green Tea Leaves (2 ml)	Yellow
T_8	2		Myanmar Green Tea Leaves (4 ml)	Yellow
T_9	4		Myanmar Green Tea Leaves (6 ml)	Pale yellow

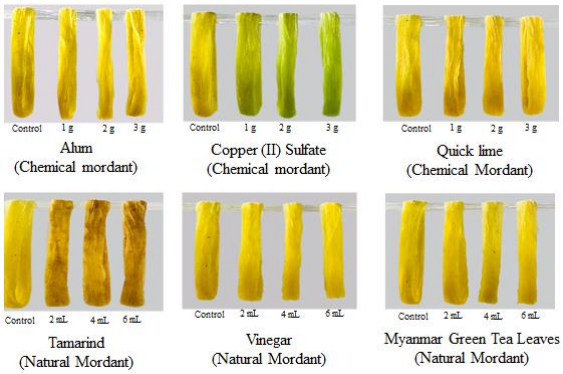

Figure (3) Color pattern of dye wools extracted from *Artocarpus heterophyllus* L.

Scientific Name - *Brassica oleraceae var. capitata* F. rubra L.
Myanmar Name - Ka-yan-gaw-phe
English Name - purple cabbage
Family - Brassicaceae
Part used - Leaves

Figure (4) Habit and Part used of *Brassica oleraceae var. capitata* F. rubra L.

Part used

Distinct character

Annual herbs. Leaves lower and basal petiolate. Inflorescence spreading. Seed globose, dark brown, finely reticulate.

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	**3**	**30 min**	**-**	**Blue**
T_1	4	30 min	Alum (1 g)	Dark blue
T_2	5		Alum (2 g)	Dark blue
T_3	6		Alum (3 g)	Pale blue
T_4	4		Copper II sulfate (1 g)	Pale purple
T_5	5		Copper II sulfate (2 g)	Pale purple
T_6	6		Copper II sulfate (3 g)	Dark purple
T_7	4		Quick lime (1 g)	Pale yellow
T_8	5		Quick lime (2 g)	Pale yellow
T_9	6		Quick lime (3 g)	Dark yellow

Table (6) Color formation of Tumeric treated with different concentration of different mordant (Natural mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	3	45 min	-	Blue
T_1	1	45 min	Tamarind (2 ml)	Pale purple
T_2	2		Tamarind (4 ml)	Pale blue
T_3	3		Tamarind (6 ml)	Pale blue
T_4	1		Vinegar(2 ml)	Pale purple
T_5	2		Vinegar (4 ml)	Pale red
T_6	3		Vinegar(6 ml)	Pale red
T_7	1		Myanmar Green Tea Leaves (2 ml)	Pale purple
T_8	2		Myanmar Green Tea Leaves (4 ml)	Pale purple

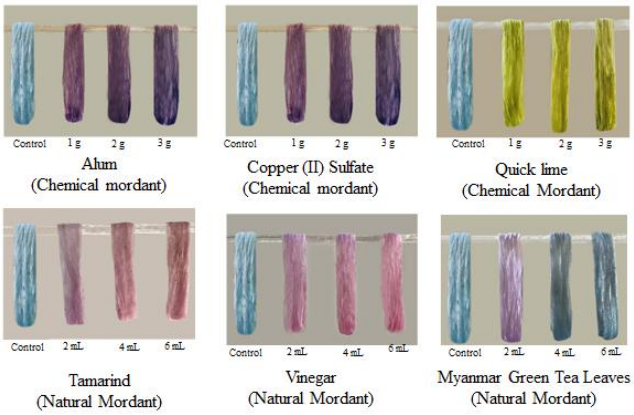

Figure (5) Color pattern of dye wools extracted from *Brassica oleraceae* var. *capitata*

F. *rubra* L.

Scientific Name - *Butea onosperma* L.
Myanmar Name - Paunk-pin
English Name - bastard teak
Family - Fabaceae
Part used - Flower

Habit

Part used

Figure (6) Habit and Part used of *Butea onosperma* L.

Distinct character

Dry-season deciduous tree. Leaves pinnate, three leaflets. Flower bright orange-red fruit pod.

Table (7) Color formation of Tumeric treated with different concentration of different mordant (Chemical mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	**4**	**30 min**	**-**	**Orange**
T_1	6	30 min	Alum (1 g)	Light yellow
T_2	6		Alum (2 g)	Light yellow
T_3	7		Alum (3 g)	Pale yellow
T_4	6		Copper II sulphate (1 g)	Pale green
T_5	6		Copper II sulphate (2 g)	Pale green
T_6	7		Copper II sulphate (3 g)	Light green
T_7	6		Quick lime (1 g)	Pale orange
T_8	6		Quick lime (2 g)	Dark t orange
T_9	7		Quick lime (3 g)	Dark orange

Table (8) Color formation of Tumeric treated with different concentration of different mordant (Natural mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	**4**	**45 min**	**-**	**Orange**
T_1	2	45 min	Tamarind (2 ml)	Pale yellow
T_2	3		Tamarind (4 ml)	Dark yellow
T_3	5		Tamarind (6 ml)	Light yellow
T_4	2		Vinegar(2 ml)	Pale yellow
T_5	3		Vinegar (4 ml)	Dark yellow
T_6	5		Vinegar(6 ml)	Dark yellow
T_7	2		Myanmar Green Tea Leaves (2 ml)	Light orange
T_8	3		Myanmar Green Tea Leaves (4 ml)	Dark orange

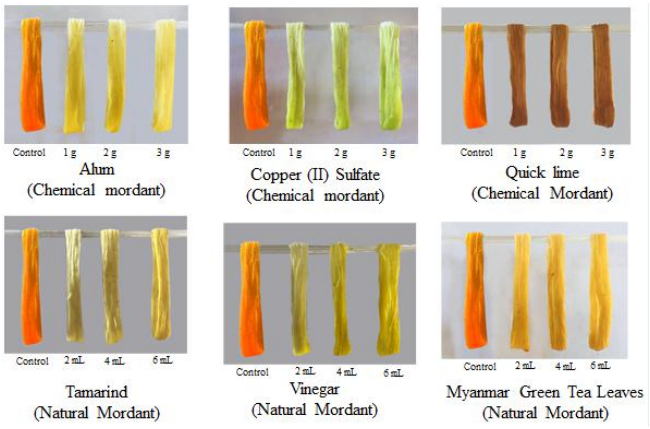

Figure (7) Color pattern of dye wools extracted from *Butea Monosperma* L.

Scientific Name - *Curcuma longa* L.

Myanmar Name - Na-nwin

English Name - Tumeric

Family - Zingiberaceae

Part used - Rhizome

Habit

Part used

Figure (8) Habit and Part used of *Butea onosperma* L.

Distinct character

Perennial herbs, tuberous rhizomes. Leaves alternate and blades. Inflorescence terminal dense spikes, bracts numerous, unequal in size and shape. Flower bisexual.ꝏ

Table (9) Color formation of Tumeric treated with different concentration of different mordant (Chemical mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	**3**	**30 min**	**-**	**Yellow**
T_1	2	30 min	Alum (1 g)	Pale Yellow
T_2	8		Alum (2 g)	Light Yellow
T_3	13		Alum (3 g)	Dark Yellow
T_4	2		Copper II sulphate (1 g)	Pale Green
T_5	8		Copper II sulphate (2 g)	Dark Green
T_6	13		Copper II sulphate (3 g)	Light Green
T_7	2		Quick lime (1 g)	Pale Scarlet
T_8	8		Quick lime (2 g)	Pale Scarlet
T_9	13		Quick lime (3 g)	Dark Scarlet

Table (10) Color formation of Tumeric treated with different concentration of different mordant (Natural mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	3	45 min	-	Yellow
T_1	4	45 min	Tamarind (2 ml)	Pale Yellow
T_2	5		Tamarind (4 ml)	Pale Yellow
T_3	6		Tamarind (6 ml)	Dark Yellow
T_4	4		Vinegar(2 ml)	Pale Yellow
T_5	5		Vinegar (4 ml)	Light Yellow
T_6	6		Vinegar(6 ml)	Light Yellow
T_7	4		Myanmar Green Tea Leaves (2 ml)	Pale Yellow
T_8	5		Myanmar Green Tea Leaves (4 ml)	Pale Yellow
T_9	6		Myanmar Green Tea Leaves (6 ml)	Dark Yellow

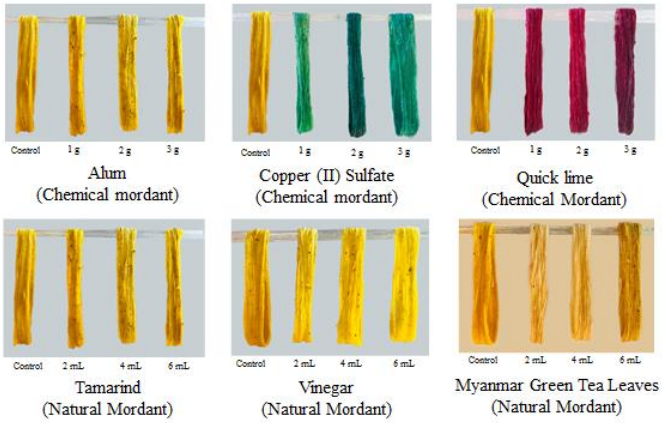

Figure (9) Color pattern of dye wools extracted from *Curcuma longa* L.

Scientific Name - *Curcuma longa* L.
Myanmar Name - Na-nwin
English Name - Tumeric
Family - Zingiberaceae
Part used - Rhizome

Habit

Part used

Figure (8) Habit and Part used of *Butea onosperma* L.

Distinct character

Perennial herbs, tuberous rhizomes. Leaves alternate and blades. Inflorescence terminal dense spikes, bracts numerous, unequal in size and shape. Flower bisexual.

Table (9) Color formation of Tumeric treated with different concentration of different mordant (Chemical mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	**3**	**30 min**	**-**	**Yellow**
T_1	2	30 min	Alum (1 g)	Pale Yellow
T_2	8		Alum (2 g)	Light Yellow
T_3	13		Alum (3 g)	Dark Yellow
T_4	2		Copper II sulphate (1 g)	Pale Green
T_5	8		Copper II sulphate (2 g)	Dark Green
T_6	13		Copper II sulphate (3 g)	Light Green
T_7	2		Quick lime (1 g)	Pale Scarlet
T_8	8		Quick lime (2 g)	Pale Scarlet
T_9	13		Quick lime (3 g)	Dark Scarlet

Table (10) Color formation of Tumeric treated with different concentration of different mordant (Natural mordant)

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	3	45 min	-	Yellow
T_1	4	45 min	Tamarind (2 ml)	Pale Yellow
T_2	5		Tamarind (4 ml)	Pale Yellow
T_3	6		Tamarind (6 ml)	Dark Yellow
T_4	4		Vinegar(2 ml)	Pale Yellow
T_5	5		Vinegar (4 ml)	Light Yellow
T_6	6		Vinegar(6 ml)	Light Yellow
T_7	4		Myanmar Green Tea Leaves (2 ml)	Pale Yellow
T_8	5		Myanmar Green Tea Leaves (4 ml)	Pale Yellow
T_9	6		Myanmar Green Tea Leaves (6 ml)	Dark Yellow

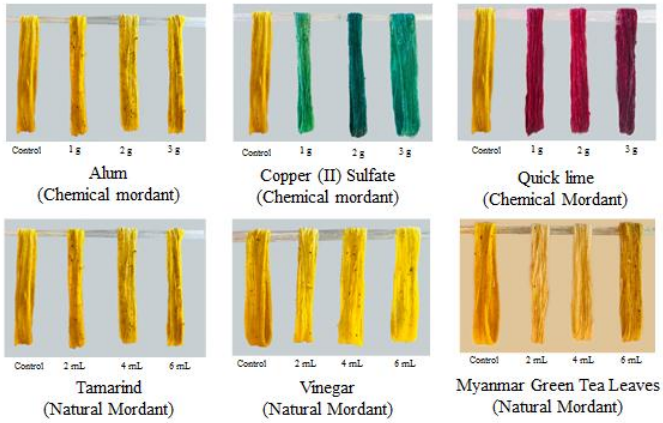

Figure (9) Color pattern of dye wools extracted from *Curcuma longa* L.

DISCUSSION AND CONCLUSION

The present study deals with the extraction of dye from various parts of five selected species were collected from Taungoo region. For the extraction of dye from selected species, the Japanese method Yamazaki (2000) and Myanmar traditional dyeing methods including different mordants had been used. The species of *Hylocereus undatus* (Haworth) Britton & Rose were shown red color dye. The species of *Artocarpus heterophyllus* L. possess yellow color dye and the orange colors were occurred in *Butea monosperma* L. and *Brassica oleraceae* var. *capitata* F. *rubra* L. showed magenta. In the preparation of raw materials, different plant parts needed to be prepared in different ways (cut into pieces, pounded, dipped in water for suitable time etc.

In this study, different types of mordants in which chemical as well as natural mordant were utilized to evaluate the effect of mordants on color formation. Besides of the mordants, the concentration of mordants was also influenced upon the formation of color pattern. The color pattern also correlated with the resulted pH of the dyestuff. These findings were in accordance with Vankar (2001) who stated that the intensity of color of dye extracted from the same plant material changes with the different types of mordants and resulted pH value. Color of the dye on the fabric was the function not only of the mordant but also of the dyeing techniques, different colors were obtained.

Red color dyes: most red dyes are hidden in root or bark of plant. Yellow color dyes: abundant of all hues in nature. This paper focus on dye derived from natural sources, which have emerged as an important alternative to synthesis dyes. The research fulfils the need for developing better solid-liquid extraction techniques for leaching natural colorants from plant materials for application in plant research, food as well as dyeing industries. The novel technique can be employed effectively for the extraction of coloring matter from various plant various plant resources even dispening with conventional heating requirement. This paper is hoped to provide effective utilization of natural resources as eco-friendly method in current situation of global environmental concern.

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