Natural Dye Extraction with Natural Mordant from Some Dye Producing Plants

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Abstract

Natural dyes derived from natural resources have emerged as an important alternative to synthetic dyes. The majority of the natural dyes are from plants. In this paper, natural dyes were extracted by using post-mordanting method from the petal of *Clitoria ternatea* L. (Aung-mae-nyo), tap root of *Daucus carota* (Hoffm) Schubl. KG Martens (Mone-lar-oo-ni), bark of *Ficus religiosa* L. (Naung-pin), leaves of *Lawsonia inermis* L. (Dan-gyi), fruit skin of *Vitis bryoniifolia* Bunge (Sa-pyit). The natural mordant such as tamarind, lime and Myanmar green tea leaves were used to fix the dye on the fabric. The resulted pH value and formation of color tones were recorded during the dyeing process. The extraction of dyes from natural resource plants is one of the commercial importance for textile or fabric industry. By using these natural mordant, the various plant parts (natural resources) gave different color pattern and also enhance to reduce the environmental pollution than chemical dyes.

Keywords: Natural dyes, synthetic dyes, post-mordanting method, textile or fabric industry, environmental pollution

Introduction

Natural dyes or colorants derived from flora are believed to be safe because of its nontoxic, non-carcinogenic and biodegradable in nature. Natural dyes are nowadays demand not only in textile industry but in cosmetics, leather, food and pharmaceuticals (Gokhale *et al*., 2004). Normally natural dyes are extracted from the roots, stems, leaves, flowers, fruits of various plants, dried bodies of certain insects and minerals. Most of the natural dyes have no substantively on cellulose or other textile fibers without the use of a mordant. The majority of natural dyes need a mordanting. (Samanta *et al*., 2010). In contrast, natural dyes are environmental friendly, exhibit better biodegradability and generally have a higher compatibility with the environmental than synthetic dyes. (Ahlstrom *et al*., 2005). The process is economically viable as the raw materials are available at low cost and so cost of production is also very low.

Materials and Methods

The different parts of plant were collected and boiled with distilled water (6000 mL) for about 60 minutes. The crude extract of dye liquid in dye bath was 1 Liter and measured the resulted pH. Then wool soaked in dye bath for 45 minutes with three types of natural mordants (Tamarind, Lime, Myanmar green tea leaves). Finally air dry in shade and observed color formation. But in the *Lawsonia inermis* L. the leaves were needed to pound before extracting dye.

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Table 1. 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 swimmer	Treatment
1	Aung-mae-nyo	Petal	600	6000	45 min	1	Cut into pieces
2	Mone-lar-oo-ni	Taproot	600	6000	45 min	1	Cut into pieces
3	Nyaung-pin	Bark	600	6000	45 min	2	Cut into pieces
4	Dan	Leaves	600	6000	45 min	1	Pounded into pieces
5	Sa-pyit	Fruit skin	600	6000	45 min	1	Peel into pieces

Results

Table 2. List of plants for extraction

No	Scientific name	Myanmar Name	English Name	Family	Part used
1.	*Clitoria ternatea* L.	Aung-mae-nyo	Butterfly pea	Fabaceae	Petal
2.	*Daucus carota subsp. sativus* L.	Mone-lar-oo-ni	Carrot	Apiaceae	Taproot
3.	*Ficus religlosa* L.	Nyaung-pin	Sacred fig	Moraceae	Bark
4.	*Lawsonia inermis* L.	Dan	Henna	Lythraceae	Leaves
5.	*Vitis bryoniifolia* Bunge.	Sa-pyit	Grape	Vitaceae	Fruit skin

Table (3). Color formation of *Clitoria ternatea* L. treated with different concentration of different natural mordant

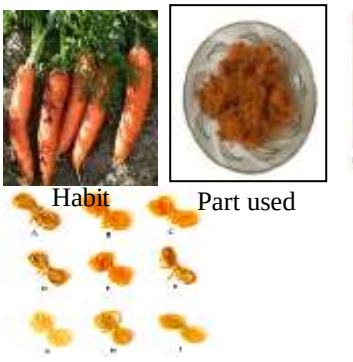
Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	acidic	45 min	-	Blue
T_1	acidic	45 min	Tamarind (4 ml)	Pale purple
T_2	acidic		Tamarind (4 ml)	Pale purple
T_3	acidic		Tamarind (6 ml)	Dark purple
T_4	acidic		Lime (2 ml)	Pale blue
T_5	acidic		Lime (4 ml)	Pale blue
T_6	acidic		Lime (6 ml)	Pale blue
T_7	acidic		Myanmar Green Tea Leaves (2 ml)	Pale blue
T_8	acidic		Myanmar Green Tea Leaves (4 ml)	Dark purple
T_9	acidic		Myanmar Green Tea Leaves (6 ml)	Dark purple

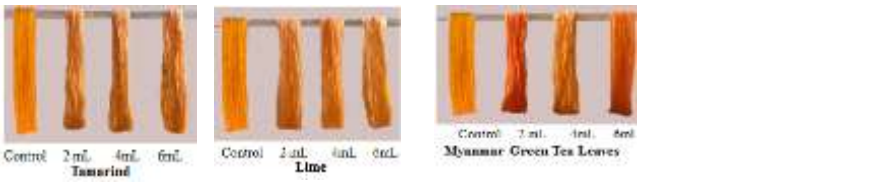
Figure 2. Habit and Part used of *Clitoraia*

Figure 3. Coloration of dye wools extracted from *Clitoraia ternatea* L.

Table 4. Color formation of *Daucus carota subsp. sativus* L. treated with different concentration of different natural mordant

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	acidic	30 min	-	Blue
T_1	acidic		-	Pale orange
T_2	acidic		Tamarind (2 mL)	Pale orange
T_3	basic		Tamarind (4 mL)	Pale orange
T_4	acidic		Tamarind (6 mL)	Dark orange
T_5	acidic	45 min	Lime (2mL)	Pale orange
T_6	basic		Lime (4 mL)	Dark orange
T_7	acidic		Lime (6mL)	Pale orange
T_8	acidic		Myanmar green tea leaves (2 mL)	Pale orange
T_9	basic		Myanmar green tea leaves (4 mL)	Dark orange





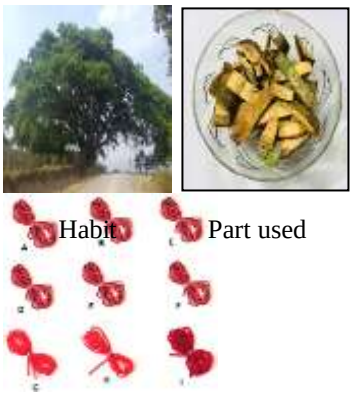


Figure 4. Habit and Part used of *Daucus carota sub sp. sativus* L.

Figure 5. Coloration of dve wools extracted from *Daucus carota sub sp.*

Table 5. Color formation of *Ficus religlosa* L. treated with different concentration of different natural mordant

Treatment	Resultant pH	Durationof dyeing	Mordant	Resultant Color
Control	acidic	45 min	-	Pale Red
T_1	acidic		Tamarind (2 ml)	Pale Red
T_2	acidic		Tamarind (4 ml)	Pale Red
T_3	basic		Tamarind (6 ml)	Dark orange
T_4	acidic	45 min	Lime (2mL)	Pale brown
T_5	acidic		Lime (4 mL)	Dark brown
T_6	basic		Lime (6mL)	Pale brown
T_7	acidic		Myanmar Green Tea Leaves (2 ml)	Pale red
T_8	acidic		Myanmar Green Tea Leaves (4 ml)	Pale red
T_9	basic		Myanmar Green Tea Leaves (6 ml)	Dark red

Figure 6. Habit and Part used of *Ficus*

Figure 7. Coloration of dve wools extracted from *Ficus relialosa* L.

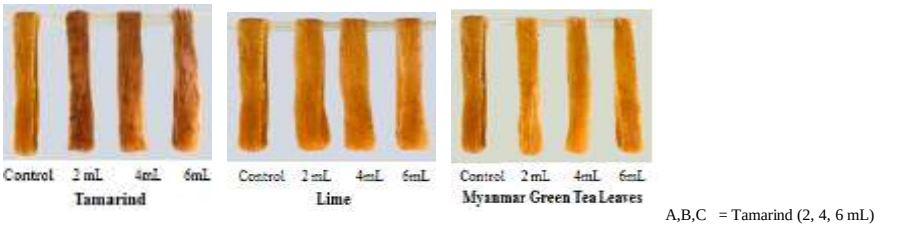
Table 6. Color formation of *Lawsonia inermis* L. treated with different concentration of different natural mordant

Treatment	Resultant pH	Duration ofdyeing	Mordant	Resultant Color
Control	acidic	45 min	-	Yellow
T_1	acidic		Tamarind (2 ml)	Dark yellow
T_2	acidic		Tamarind (4 ml)	Dark yellow

T_3	basic	45 min	Tamarind (6 ml)	Pale yellow
T_4	acidic		Lime (2mL)	Pale orange
T_5	acidic		Lime (4 mL)	Pale orange
T_6	basic		Lime (6mL)	Pale orange
T_7	acidic		Myanmar Green Tea Leaves (2 ml)	Light orange
T_8	acidic		Myanmar Green Tea Leaves (4 ml)	Light orange
T_9	basic		Myanmar Green Tea Leaves (6 ml)	Pale orange

Habit Part used

Figure 8. Habit and Part used of *Lawsonia inermis*



A,B,C = Tamarind (2, 4, 6 mL)
D,E,F = Vinegar (2, 4, 6 mL)
G,H,I = Myanmar green tea leaves (2, 4, 6 mL)

Figure 9. Coloration of dve wools extracted from *Lawsonia inermis* L.

Table 7. Color formation of *Vitis bryoniifolia* Bunge. treated with different concentration of different natural mordant

Treatment	Resultant pH	Duration of dyeing	Mordant	Resultant Color
Control	acidic	45 min	-	Magenta
T_1	acidic		Tamarind (2 ml)	Pale red
T_2	acidic		Tamarind (4 ml)	Dark red
T_3	basic		Tamarind (6 ml)	Dark red
T_4	acidic		Lime (2mL)	Pale pink
T_5	acidic		Lime (4 mL)	Pale pink
T_6	basic		Lime (6mL)	Pale pink
T_7	acidic		Myanmar Green Tea Leaves (2 ml)	Dark purple
T_8	acidic		Myanmar Green Tea Leaves (4 ml)	Dark purple
T_9	basic		Myanmar Green Tea Leaves (6 ml)	Pale purple

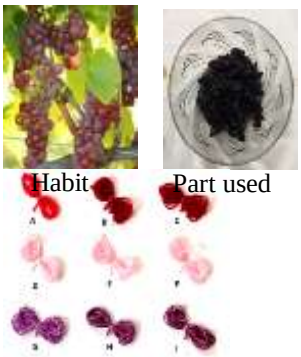


Figure 10. Habit and Part used of *Vitis brvoniifolia* Bunge.

A,B,C = Tamarind (2, 4, 6 mL)
D,E,F = Vinegar (2, 4, 6 mL)
G,H,I = Myanmar green tea leaves (2, 4, 6 mL)

Figure 11. Coloration of dye wools extracted from *Vitis brvoniifolia* Bunge.

Discussion and Conclusion

Natural dyes have played an important role in the ecological and cultural heritage of human civilizations. Although plants exhibit a wide range of color, not all of these pigments can be used as dyes. Dyes are organic compound which are widely used for imparting color to textiles (Hendery, 1995). In this paper, the three natural mordant such as, vinegar, tamarind and Myanmar green tea leaves were selected to improve color fastness by using Yamazaki method (2000). According to the color formation the concentration of mordant and resulted pH value were also influenced on color pattern. A part from these, mordanting improves fastness, often also exhaustion and additionally it makes desirable deepening and interesting spectral alternation of a color (Vankar, 2001).

Natural dyes were extracted by using post-mordanting method from bark of the petal of *Clitoria ternatea* L. (Aung-mae-nyo) gave purple color, tap root of *Daucus carota* (Hoffm) Schubl. KG Martens (Mone-lar-oo-ni) show orange color, *Ficus religiosa* L. (Naung-pin) performed brown and red color, leaves of *Lawsonia inermis* L. (Dan-gyi) gave yellow and orange color, fruit skin of *Vitis bryoniifolia* Bunge (Sa-pyit) expressed red, pink and purple color. These findings are in accordance with Abel (2012) He stated that 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 from natural resources. Natural dye extraction needed to carry out an extensive research and development. However, natural dyes come from natural resources are not harmful to the environment; biodegradable and disposing them don't cause pollution.

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