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EXTRACTION OF PLANT BASED TEXTILE DYES

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Abstract: Plant are one of the main source of natural textile dye. Environmental friendly natural dyes are gaining interest among people. The present study was employed to identify the fabric dyeing capacity of different plant samples using alum as the mordant. The extracted dye was successfully applied and it imparted soothing shades on the selected textile fabric. Today natural dyes are reviving its consumer interest as the awareness among the people regarding the environmental issues caused by production and application of synthetic dyes have increased. Attempts to improve the production and commercialization of natural dyes have to be given prime importance**.** Scientific study on improvement of quality, extraction, yield, and optimization of dye of natural dye must be accelerated. Systematic research on production, processing, trade and market also should be brought into consideration. Large scale dyeing units with natural dyes are now a reality in the textile market of safer, environment friendly and sustainable textiles.

Index Terms **– Natural dye, mordant, environment friendly, sustainable.**

I. INTRODUCTION

Nature is a portray of vibrant colors. Human beings have always been fascinated by colors and the interest for colors is as old as our civilization. People used to extract colors from natural sources like plants, animals as well as minerals. The dyeing with these natural sources was one of the oldest technique practiced. With the advent of synthetic dyes and its increased production and application, the use of natural dyes slumped sharply (Holme, 2006). However, recent environment concern has slowly revived the use of natural dyes among people. Today consumers are willing to pay a higher amount for nature based products due to health concerns (Singh & Tyagi, 2015)). The global demand for natural coloring agents will be increasing in the near future.

Natural dyes are considered environment friendly since they are biodegradable and can be renewed easily. They are also proved to be safe due to non-toxic and non-carcinogenic properties (Aminoddin, 2010). These dyes can be used for dyeing almost all types of natural fibres. Recent research shows that they can also be used to dye some of the synthetic fibers (Saxena and Raja 2014).

Plants are one of the main potential source of natural textile dye. Plant parts including flowers, buds, fruits, stems, bark, leaves, roots, husks and so on serves as the dye sources (Bachanan, 1995). Even though plant based textile dyes are easily available, less toxic, non-hazardous and renewable than the synthetic dyes, the technique for extraction of dyes from different plant parts and the method of application has to be dealt scientifically. It's the right time to put serious thoughts on evaluation of potent dye samples and its appropriate mordants. Thus by keeping in view of above, the present study was conducted to identify the plant source, extraction of dye, dyeing of selected fabric using the selected dye and mordant and evaluation of the resultant color.

II. MATERIALS AND METHODS

2.1Collection of material

Different plant samples were used to dye the fabric. The selected parts of the plants for dyeing procedure were collected from places near the residence and within the college campus. Some materials were brought from the local shops (Table.2.1 and Plate.2.1). White cotton fabric was purchased from Khadi Bhavan, Pallimukku, Ernakulam, Kerala.

Table 2.1: List of plants used for dyeing

Sl. No.	Common Name	Botanical Name	Family	Parts used
1	Avocado	*Persea americana*	Lauraceae	Dried exocarp
2	Beetroot	*Beta vulgaris*	Amaranthaceae	Root
3	Coffee	*Coffea arabica*	Rubiaceae	Powdered seeds
4	Henna	*Lawsonia inermis*	Lytheraceae	Leaves
5	Hibiscus	*Hibiscus rosa sinensis*	Malvaceae	Flowers
6	Indigo	*Indigofera tinctoria*	Papilionaceae	Leaves
7	Mango	*Mangifera indica*	Anacardiaceae	Ripe fruit
8	Marigold	*Tagetes erecta*	Asteraceae	Flowers
9	Onion	*Allium cepa*	Liliaceae	Tunics of bulb
10	Papaya	*Carica papaya*	Caricaceae	Leaves
11	Saffron	*Crocus sativus*	Iridaceae	Stamen
12	Sappan wood	*Caesalpinia sappan*	Caesalpiniaceae	Wood
13	Tea	*Camellia sinensis*	Theacaeae	Dried tender leaves
14	Teak	*Tectona grandis*	Verbenaceae	Young leaves
15	Turmeric	*Curcuma longa*	Zingiberaceae	Rhizome

Plate.2.1 Plant samples used for dyeing 1. Avocado, 2. Beetroot, 3. Coffee,4. Henna, 5. Hibiscus, 6. Indigo, 7. Mango, 8. Marigold yellow, 9. Marigold orange, 10. Onion, 11. Papaya,12. Saffron,13. Sappan wood, 14. Tea, 15. Teak, 16. Turmeric

2.2Mordanting

Alum was used as the mordant for the study. Alum was purchased from Chemical and Laboratory store Kacheripady, Ernakulam, Kerala. One teaspoon (4.2 g) of Alum was dissolved in 500 ml of hot water.

2.3Preparation of fabric or Scouring

The cotton fabric was cut into 12 x 12 cm sized square pieces and washed using detergent to remove the starch and other chemical compounds present in the fabric. Then the fabric was washed thoroughly in running tap water to remove the detergent. The fabric was then mordanted by dipping in 500 ml alum solution for 15 minutes.

2.5Dyeing of Fabric

The pretreated fabric was dipped in 500ml of the extracted dye and boiled using water bath at 100°C for one hour. The material was then removed and washed with 1% of detergent and water. Dyed fabric were then dried in shade.

III. RESULT AND DISCUSSION

The natural dye was successfully extracted and different shades of pleasant colors where produced in the cotton fabric using alum mordanting method (Plate.3.1 & 3.2) (Table.3.1). Extraction of dye using water is one of the oldest and the cheapest method among all the other methods of dye extraction (Abdu & Yusuf, 2015; Shahid *et al.,* 2009; Raja *et al.,* 2010). Mordants help to improve dye absorption by the fabric by forming insoluble compound with dye (Priti & Ravindra, 2013).

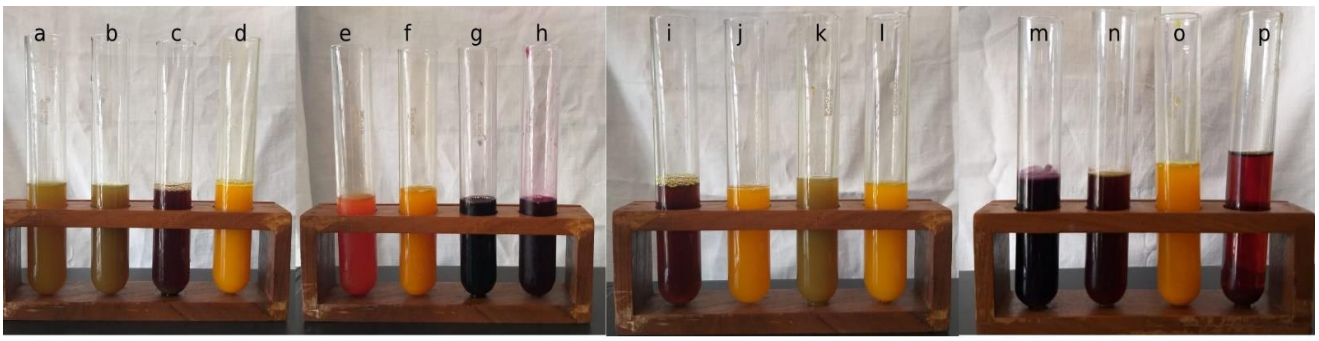

Plate.3.1 Dye extracted from different plant parts a. Avocado, b. Henna, c. Sappan wood, d. Turmeric, e. Marigold orange, f. Marigold yellow, g. Indigo, h. Beetroot, i. Onion, j. Saffron, k. Papaya, l. Mango, m. Hibiscus, n. Tea, o. Teak, p. Coffee.

Table 3.1: Colors obtained after dyeing

Sl. No.	Common Name	Color
1	Avocado	Light brown
2	Beetroot	Pink
3	Coffee	Brown
4	Henna	Light Brown
5	Hibiscus	Lavender
6	Indigo	Light blue
7	Mango	Lemon yellow
8	Marigold orange	Golden Yellow
9	Marigold yellow	Bright yellow
10	Onion	Olive green
11	Papaya	Light green
12	Saffron	Light yellow
13	Sappan wood	Maroon
14	Tea	Beige
15	Teak	Peach
16	Turmeric	Bright yellow

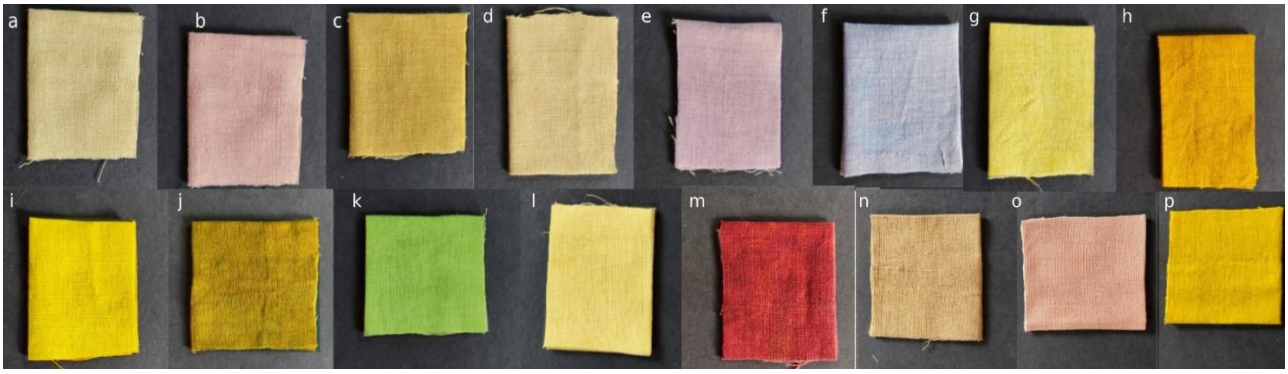

Plate.3.2 Dye extracted from different plant parts a. Avocado, b. Beetroot, c. Coffee, d. Henna, e. Hibiscus, f. Indigo, g. Mango,h. Marigold orange, i. Marigold yellow, j. Onion, k. Papaya, l. Saffron, m. Sappan wood, n. Tea, o. Teak, p. Turmeric.

In the present study, dried Avocado shells and the outer scaly skin of onion contained light brown color and olive green respectively. Outer onion skin contains anthocyanin as principal compound. The effectiveness in fabric depens upon the quality of anthocyanin present in it. It is a water soluble compound and can be easily extracted. Lokhande and Dorugade, (1999) discovered four cyaniding compound from onion skin. Outer scaly skin of Onion is considered as an agricultural waste which makes the extracted dye less expensive. Waste products from different food processing industries and agricultural fields can be used as an inexpensive source of natural dye (Ozlenen *et al.*, 2014; Wan *et al.*, 2011). Thus outer scaly skin of Onion can be considered as an efficient raw material for natural dye.

Orange and yellow Marigold showed beautiful shades of yellow. The maximum absorption was obtained at 100°C for one hour using alum as the mordant. Dye absorption by the fabric increase till it reaches the optimum temperature. Guinot *et al.*, (2008) analysed and identified flavonoid the pigments of marigold flowers. The uptake of the dye increases with increase in temperature due to expanding of yarn (Kamel *et al.*, 2007; Shenai, 1997). Positive results were obtained by dyeing with Beetroot and Hibiscus which yielded pink and lavender shades. Beetroot contains betaxanthins yield pink to purple shades (Strack *et al.*, 1993). Anthocyanin are compounds that yield dark blue shades and their color ranges may slightly vary. Petals of Hibiscus also contain anthocyanin which yield favorable blue to violet shades during dying (Harbone & Grayer, 1988).

Henna, Papaya leaves, Indigo and Teak also gave unexpected colors like light brown, light green, light blue and peach shades respectively. Henna is a naphthoquinone derivative, it dyes fibres very well to orange, maroon, dark brown or burgundy hues. Agarwal *et al.*, (1992) explained fabric dyed with henna showed wide range of colors such as beige, yellowish brown, dull yellow with different concentration of alum, chrome and ferrous sulphate as mordants. *Indigofera tinctoria*, contain indicant a chemical compound which belongs to indgoid group of dye (Kokubun *et al.*, 1998). Indigo dyes are poorly soluble in water and are difficult to color the fabric in bright blue color without proper treatments (Krizovz, 2009). Turmeric, Saffron and Mango also yield different hues of yellow. Turmeric contain curcumin which is responsible for imparting bright yellow color and can be used as direct dye (Krizovz, 2014). Coffee and Tea gave brown and beige color to the fabric. Tea possess tannins which are responsible to impart light brown shade (Krizovz, 2009). Thus from the result it is clear that the plant materials used in the study can be used as a source of natural textile dye. The major drawback of natural textile dyes is its inconsistency of color and less availability of raw material (Kulkarni *et al.*, 2011). Therefore, there is a need for extensive research in developing stable dyes and uplifting the application of natural dyes in the modern textile industries.

IV.CONCLUSION

Natural dyes are naturally occurring chemical compounds which can impart color to food, fabrics, fibers, cosmetics, medicines and so on. Plants are one of the main source of natural dye and is responsible for giving wide range of colors. The present study was carried out to study the dyeing capacity of various plant samples. The natural dye was successfully extracted and applied on cotton fabric. Natural textile dyes are gradually receiving more attention than their synthetic counterpart. They can offer a clean production and environment friendly model for textile dyeing. The availability of natural dyes can be increased to very high level by the scientific interventions like biotechnology, genetic engineering etc. The natural dyes will be always a sustainable choice against the synthetic dye as it the only environment friendly option.

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