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STUDIES ON THE APPLICATION OF SOME LESS KNOWN ETHNO MEDICINALLY DYE YIELDING PLANTS FOR DYEING IN COTTON CLOTH WITH FOCUS ON CONSERVATION STRATEGIES IN PASCHIM MEDINIPUR DISTRICT, WEST BENGAL, INDIA: A NEW APPROACH

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ABSTRACT

The use of natural dyes has increased during the last couple of decades, looking at the bad effects of synthetic dyes. Natural dyes are considered to have lower side effect, less hazards, less polluting, less toxic and non carcinogenic. The present paper deals with the preparation of natural dyestuff extracted from four dye yielding plants which is less known (belonging to four families) available in the district of Paschim Medinipur. The extraction of dyes from different plant parts of the selected dye yielding plants was carried out using aqueous solution. Cotton cloth is widely used for this experiment and also used the safe common mordant alum is used for color fastness of dyed cloth. The light fastness, wash fastness and rub fastness test of the dyed material were also carried out. The study focus to on the ethno medicinal value of natural dye yielding plants of this district and to highlight on the use of natural dyes as a source of different color shades using safe eco-friendly mordant. Also put on light It is extremely essential to make a conscious effort on conservation of such natural dye yielding plant species and proper documentation and effort should be made needed to increase the production of natural dyes on a large scale basis in this district, otherwise we are bound to lose vital information on the utilization of natural dyes resources around us.

Key words: Ethno medicinal, Natural dye yielding plants, Cotton cloth, Mordant, Color fastness, Conservation.

INTRODUCTION

The ability of natural dyes to color cotton textiles has been known since ancient times. Chemical tests of red fabric found in the tomb of king Tutankhamen in Ezypt show the presence of Alizarin a pigment extracted from madder. The earliest written record of the use of natural dyes was found in China period dated back to 2600 B.C. It was found that colour on clothing has been practiced during the Indus valley civilization at Mohenjodaro and Harappa (3500 B.C) (Siva, 2007). In ancient times in India traditionally Holi was played using different color extracted from different flowers like Seuli (*Nyctanthes arbor-tristis*), Palash (*Butea monosperma*) etc. The natural dyes present in plants and animals are pigmentry molecules which impart colour to the materials. These molecules containing aromatic ring structure coupled with a side chain are usually required for resonance and thus to impart color. There is a correlation of chemical structure with color, chromogen-chromophore with auxochrome (Purrohit, 2011). In those times of 'Holi' festivals were safe because the natural dyes were not harmful for the human body, but recent times a few cheaper chemical dyes are commonly used broadly in the market as alternative of natural dyes which causes different health hazards like skin allergiy, respiratory, kidney and liver

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diseases. Research has shown that the natural dyes are quite safe and environment friendly (Mohanta and Tiwari, 2005). The production of synthetic dyes depend on petrochemical sources and some of the synthetic dyes contain toxic or carcinogenic components which are not ecofriendly and detrimental to the human health. In recent years there has been an excessive use of synthetic dyes. It is estimated to be 10,000,000 tons per anuum, the production and application of which release vast amount of unused and unfixed colorants causing serious health hazards and disturbing the ecobalance in nature (Goodarzian, 2010). In India, more than 450 plants out of 17000 plants have been recorded to produce dyes (Chandramouli, 1995). Almost all parts of the plants like roots, bark, fruits, leaf, wood, seed, flower etc. produce dyes. Paschim Medinipur district has a diversity of forest flora and ethnic and local communities like Santal, Lodha, Munda, Oraon etc. The present study is to focus on 10 natural dye yielding plants which are less known and its application in dyeing cotton cloth. The studies also focus on the conservation of these less known natural dye yielding plants.

MATERIALS AND METHODS

The dye was extracted from the selected different parts of the selected plant samples collected from the different surveyed zones of Paschim Medinipur district during March 2011to April 2012. These includes (1) Jhargram (22º26'59" N latitude and 87º00'4" E longitude) (2) Belpahari (22º41'10" N latitude and 86º36'56" E longitude) (3) Kankrajhore forest (22º42'13" N latitude and 86º36'24" E longitude) (4) Chilkigarh (22º27'11" N latitude and 86º53'02" E longitude) (5) Sutan forest (22º53'02" N latitude and 86º47'06" E longitude). Herbarium of collected plant specimens have been deposited in Botany Department herbarium (VUH), Vidyasagar University, Midnapore, West Bengal.

Dye extraction

The fresh plants parts like root, stem, leaf, flower, fruits, seeds etc. were collected and then crushed in aqueous solution (10 gm sample in 100 ml distilled water). The extraction process was carried out at a temperature range from 80-85º C for 30 minutes. After the extraction procedure was complete, the selected plant parts were taken out from the liquor. This extraction was then filtered and used for dyeing.

Dyeing procedure

Cotton cloth is used for dyeing which was first boiled in NaOH solution (for 20 minutes) for removing starch from the cloth and then washed with cold distilled water. This cloth was then transferred into the common eco friendly mordant like alum for 30 minutes followed by treatment in the dye bath for 1 hour. Natural dyes are substantive and requires a mordant to fix the color and prevent it from either fading with exposure to light or washing out. Effect of dye without mordating the fabric was also studied. After mordating the cloth was then dried in sunlight.

Colour fastness test

The fastness of the dyed material was then tested by exposing to light, wash and rub fastness respectively. Light fastness was analyzed by exposing the dyed material to direct sunlight for 12 hours. Wash fastness was tested by washing the dyed cotton cloth with non ionic soap water (1gm/lit) and rub fastness was carried out by rubbing the fiber and checking the fading of color (Adeel *et al.*, 2009; Raja, 2010; Mishra and Patni, 2011; Kulkarni *et al*., 2011; Grover and Patni, 2011).

RESULTS

In the study about four dye yielding plants (Fig. 1-4) belonging to four families were widely used for the color fastness tests. Extraction of dye of different parts of the plants was easily done in hot water. It was observed that colour strength increased whenever the quantity of plant parts was increased to 10 to 25 gm per 100 ml boiling water for 1 hour. By following this extraction method the dye from different plant parts produce fastness properties (light, wash and rub fastness) on cotton cloth dyed with mordant shown in Table-1. It has also been observed that whenever the alum mordant and dye concentration are increased there is improvement in the light fastness properties in the cotton cloth.

Legend to figures:

Fig. 1-Dye yielding parts flower of *Butea superba* Roxb. Ex Willd.
Fig. 2-Dye yielding parts fruit's Glandular hair of *Mallotus philippensis* Muell.
Fig. 3-Dye yielding parts stem and root bark of *Ventilago denticulata* Willd.
Fig. 4-Dye yielding parts flowers of *Woodfordia furticosa* Kurz
Fig. 5- The un dyed white cotton cloth
Fig. 6- Dye extracted from *Butea superba* Roxb. Ex Willd. without mordant dyed white cotton cloth to light yellow colour and with mordant dyed white cotton cloth to deep yellowish brown colour.
Fig. 7- Dye extracted from *Mallotus philippensis* Muell.-Arg.without mordant dyed white cotton cloth to light reddish-brown and with mordant dyed white cotton cloth to dark reddish-brown.

Fig. 8- Dye extracted from *Ventilago denticulata* Willd.without mordant dyed white cotton cloth to reddish brown colour and with mordant dyed white cotton cloth to deep reddish brown colour.
Fig. 9- Dye extracted from *Woodfordia furticosa* Kurz without mordant dyed white cotton cloth to light brown and with mordant dyed white cotton cloth to dark brown colour.

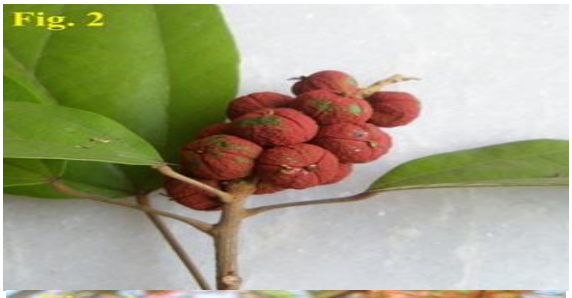

Table 1. Fastness properties (Light, Wash and Rub fastness) for cotton cloth dyed with selected dye yielding plant extracts of Paschim Medinipur district

Sl. No.	Plant name	Light fastness	Wash fastness	Rub fastness
1	*Butea superba* Roxb. Ex Willd.	Good	Moderate	Moderate
2	*Mallotus philippensis* Muell.-Arg.	Pour	Moderate	Good
3	*Ventilago denticulata* Willd.	Moderate	Good	Good
4	*Woodfordia furticosa* Kurz	Moderate	Moderate	Moderate

Table 2. Detailed information on the selected dye yielding plant from Paschim Medinipur district

Sl. No.	Plant name	Family	Local name	Current Status	Dye yielding parts	Produce dye	Ethno medicinal Uses
1.	*Butea superba* Roxb. Ex Willd.	Fabaceae	Laramurup (Lo.*****.), Narimurup (Sa.*****), Latpalash, Latapalash (Ben*****)	Wild, infrequent	Flowers	Deep yellowish orange	Decoction of stem bark applied to children for inducing sleep; stem bark juice used as an antiseptic. Flower used as diuretic and astringent.
2.	*Mallotus philippensis* Muell.-Arg.	Euphorbiaceae	Dalguri, Kamala, Sindure, Gara-sinduri (Lo.)	In frequent	Glandular hair	Red	Fruits crushed glandular hairs known as kamala powder used as anthelmintic, cathartic and styptic; also used for destroying tape worms, externally in treatment of skin diseases like ring worm & scabies.
3.	*Ventilago denticulata* Willd.	Rhamnaceae	Bangasarjo m, Sangasarjo m (Lo.), Nadnaru (Sa.), Raktapita (Ben.)	Wild, infrequent	Stem and root bark	Red	Root bark paste applied as cure for wounds, eye disease**.** Santals give stem bark decoction with paste of *Piper nigrum* Linn. (Black pepper) to treat stomach ulcer, stem bark paste also applied to all body pain.
4.	*Woodfordia furticosa* Kurz	Lythraceae	Dhawaiba, Ichakba (Lo.**)**, Patakalu (Sa.**)**, Dhatki (Ben.)	Wild, Common in open dry mixed forests.	Flowers	Brick red	Ethnic communities give flower decoction with honey against seminal weakness, calyx boiled in ghee applied to boils.

Lo. *-Lodha, Sa. *-Santal, Ben*-Bengali

DISCUSSION

Several earlier works proposes that Alum or aluminum sulphate should be used as mordant in dyeing with natural dyes (Das *et al.*, 2006; Samanta and Agarwal, 2009). The intensity of the color produce on cloth by dyeing without mordating was found to be slightly less

than that obtained for alum and dye used successively (Fig. 5-9). The mordanted cotton cloth was immediately used for dyeing because some mordant are light sensitive. The chromatophore and dye makes it resistant to photochemical attack, but the auxochrome may alter the fastness (Jothi, 2008). Good light fastness was observed in fabric dyed with dyed with the dye extracted from *Butea superb*. Cotton cloth dyeing with *Butea superba* and *Woodfordia furticosa* showed moderate wash fastness. Moderate light fatness was occurred due to the formation of complex of metal which protected the chromatophore from photolytic degradation. It has been proved that light fastness of many natural dyes particularly which are extracted from flowers parts are found to be poor to medium (Samanta and Agarwal, 2009). Wash fastness of dye is influenced by the rate of the dye inside the fiber (Jothi, 2008). The cotton cloth dyed with stem bark of *Ventilago denticulata*. showed good wash fastness properties while *Butea superb* and *Woodfordia furticosa* showed moderate wash fastness but *Mallotus philippensis* showed poor fastness. Rub fastness was carried out by rubbing the fiber and checking of the shades. Good rub fastness was exhibited by the fiber dyed using dye extracted from 2 plants out of 4 except *Butea superba* and *Woodfordia furticosa* which showed moderate rub fastness of cotton cloth. The solar drying, soap washing and rubbing did not alter the color shades developed during the dyeing process i.e. color, light and wash fastness respectively. The color on cotton cloth has no side effect on skin and it has no harmful effect on environmental also. From the economic point of view it has been calculated the whole dyeing process is viable because the easy availability of raw material at low cost and also the labor equipments and the cost of production are very cheap. The tribal or local ethnic people of this district like Santal, Lodha, Munda, Oraon, Mahato, Chitrakar, etc (Das *et al.*, 2011) use these plants for dyeing their cloths, making Patchitra, coloring mats and for other decorative purposes. They also use these plants medicinally for preparation of drugs following their indigenous methods. However it is a great concern of today because the local or tribal people in this district are fast loosing their interest in a great heritage and indigenous knowledge about dye yielding plants, extraction method and their uses. It has been observed that in recent times only the old tribal people have knowledge about these plants but their younger generations are no longer interested in their practices (Das and Mondal, 2012). Each species is arranged alphabetically and is provided correct botanical name, local name, family, dye yielding plant parts, produced dye and their local medicinal uses are given below in Table-2.

CONCLUSION

The present work showed that the selected dye yielding plants which are less known in this district can be efficiently used as sources of dye for coloring cotton cloth. Good fastness properties were exhibit by the use of mordant. It is because the mordant makes the dye colour fast. It can be suggested that to improve the light and wash fastness of these dyed cotton fabric, they should be treated with selective cationic or natural dye fixing agents. Previous literature reveals the chemical composition of different dye yielding parts of these plants but no reports exist so far on the extraction of dyes from these four plants species and also their application for dyeing in cotton cloth in this district. It has been found from this investigation that isolated dye from the most of the plant parts can be used successfully for dyeing cotton cloth to obtained wide range of light and brilliant color by using common natural mordant alum. Keeping in views the color fastness, most of the testing sample showed excellent light, wash and rub fastness and this data will be of great help to the textile industries. These data give us different parameters for evolution of fastness properties under consideration and which will be helpful to textile industries for utilization of natural dyes isolated from these plant parts. There is need for knowledge on collection, documentation and assessment of dye yielding plants. Protection and conservation of some less known species which are less available in this district like *Butea superba* Roxb., *Mallotus philippensis* Muell., *Ventilago denticulata* Willd. and *Woodfordia furticosa* Kurz etc. are essential otherwise we are bound to lose this indigenous knowledge of dye production forever.

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