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Application of Eclipta Leaves, *Achras Zapota* Leaves and *Nyctanthes Arbortristis* Flowers on Organic Cotton Fabric with Bio Wash

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Abstract

To rescue from the harmful effects of those chemical wastes the research work was focused on eco friendly natural dyes. The best in eco-friendly fabrics, "Organic cotton" was selected for the study. Extracted natural dyes from the selected natural resource (Eclipta Leaves, *Achras Zapota* Leaves and *Nyctanthes Arbortristis* Flowers) were applied onto organic cotton yarn with no using of chemicals & mordents. Enzymatic Bio wash has been further done to the naturally dyed organic cotton fabric. The colorfastness properties of natural dyed organic cotton fabric were observed and concluded.

Keywords: Achras Zapot: Cellulase enzyme: Eclipta: Nyctanthes Arbortristis: Sapindus seeds

Introduction

Environmental issues are becoming more crucial all over world. Textile processing industry is characterized not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes [1].

Organic cotton fabrics are generally understood as cotton that is grown from plants without chemical fertilizers or pesticides which are not genetically modified, though organic cotton has less environmental impact than conventional cotton and it costs more for its production [2,3].

Natural dyes can exhibit better biodegradability and generally have a higher compatibility with the environment. Natural dyes are obtained from substances such as flowers, trees, shrubs, buries, lichens, shellfish, leaves, insects and minerals [4-8].

The three herbs Eclipta Leaves, *Achras Zapota* Leaves and *Nyctanthes Arbortristis* Flowers were selected since Eclipta leaves are anti toxicity in nature, Zapota leaves demonstrated character of antioxidant activity and *Nyctanthes Arbortristis* flowers has antiviral and antifungal activities in vitro [9-11].

Today enzymes have become an integral part of textile processing. Enzyme application is inevitable tool in modern industry where environmental aspect plays critical role to sustain in the competitive market. Enzyme (Cellulase) treatment gives the fabric a smoother and glossier appearance [4-8].

Materials and Methods

Selection of yarn

Organic cotton was purchased in yarn stage from the yarn dealer, Erode, Tamil Nadu which is of 80s count since the end use is going to be used for baby wear. Fabric Specifications are shown in Table 1a.

Methods

Scouring

Scouring was done using Sapindus seeds without using of chemicals. Sapindus seeds (Figures 4a and 4b) were collected from Coimbatore Agricultural University. The sapindus seeds were dried under shade and ground to fine powder. The scouring of organic cotton yarn was done in the bath with liquor ratio 1:20 with 5 g/l of sapindus seeds solution (soap nut) using laboratory winch machine. The yarn was loaded into the bath at 400°C to 500°C for 3hours. The yarn was then thoroughly washed with cold water and dried.

Bleaching

Catalase Enzyme is the bleaching agent which is chosen for the study to bleach the organic cotton yarn.

The bleaching of organic cotton yarn was done in the bath with liquor ratio 1:20 with catalase enzyme treated with 3% using laboratory winch machine. The bath was heated to 900°C and the yarns were bleached for 60 mins. The yarn was washed twice pin hot water and cold water.

Selection of dye

Eclipta leaves, Achras Zapota leaves and Nyctanthes Arbortristis

Count	80s
Loom	Pit loom
Ends per inch	76
Picks per inch	43
Fabric Thickness	0.28mm
Weave	Plain weave

 Table 1a: Fabric Specifications.

Colour fastness to washing	Change in colour	Staining
Eclipta	4	3
Achras Zapota	4	3
Nyctanthes Arbortristis	3	4

NOTE: 1-Very poor, 2-Poor, 3-Medium, 4-Good, 5-Excellent

 Table 1b: Colour fastness to washing of dyed organic cotton fabrics.

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Page 2 of 4

flowers have been collected from Coimbatore area and it is used as natural eco friendly dyeing agent. The specified three (Eclipta leaves, *Achras Zapota* leaves and *Nyctanthes Arbortristis* flowers) herbs were selected (Figures 5a-5c).

These three herbs were selected because of the following aspects as per the literature review, Eclipta leaves are anti toxicity in nature, Zapota leaves demonstrated character of antioxidant activity and *Nyctanthes Arbortristis* flowers has antiviral and antifungal activities in vitro.

Main active principle constituents of Eclipta leaves are coumestans such as wedelolactone and demethylwedelolactone, polypeptides, polyacetylenes, thiophene derivatives, steroids, triterpenes and flavonoids, Structure of wedelolactone is shown in Figure 1 and the structure of Zapota leaves in Figure 2.

Chemical constituents of Nyctanthes arbor-tristis flowers (Figure 3) contain essential oils, nyctanthin, D-mannitol, tannins, glucose, carotenoids, glycosides including β -monogentiobioside ester of a-crocetin (or crocin-3), β -monogentiobioside- β -D monoglucoside ester of a-crocetin, and β -digentiobioside ester of a-crocetin (or crocin-1).

Extraction of natural dye solution from Eclipta

250 gms of Eclipta leaves are shadow dried and ground well to fine powder. 1 liter of boiling water was added to the finely powdered dried eclipta leaves for about 2-3 hours. Then it is filtered using nylon cloth.









Figure 4a: Sapindus Seeds.



Figure 4b: Sapindus Seeds Powder.



Figure 5a: Eclipta Leaf.



Figure 5b: Nyctanthes Arbortristis flowers.

Extraction of natural dye solution from Achras Zapota

Achras Zapota fresh leaves were boiled in 1 litre of water for about 2-3 hours. Then it is filtered using nylon cloth.

Extraction natural dye solution from Nyctanthes Arbortristis

Nyctanthes Arbortristis fresh flowers were boiled in 1 litre of water for about 2-3 hours. Then the extracted dye solution is filtered using nylon cloth.

Application of Natural Dyes on Organic Cotton Yarn

The dyeing of organic cotton yarn was done in the bath with liquor ratio 1:20 with 10 gpl of dye solution using Laboratory winch dyeing machine. The yarn was loaded into bath at 900°C to 1200°C for 2-3

Page 3 of 4



Colour Fastness to Rubbing	Dry	Wet
Eclipta	4	3
Achras Zapota	3	4
Coral jasmine	3	4

NOTE: 1-Very poor, 2-Poor, 3-Medium, 4-Good, 5-Excellent

 Table 2: Colour fastness to rubbing of dyed organic cotton fabrics.

Colour fastness to Sun light	Change in colour	Staining
Eclipta	4	3
Achras Zapota	4	3
Nyctanthes Arbortristis	3	4

NOTE: 1-Very poor, 2-Poor, 3-Medium, 4-Good,5-Excellent

Table 3: Colour fastness to sunlight of dyed organic cotton fabrics.

hours. The dyed yarn was washed thoroughly in cold water and then squeezed and shade dried.

Hand loom weaving

The yarn is then woven into fabric using pit loom.

Bio wash

Cellulase Enzyme is the washing agent which is chosen for the study for the bio wash process of dyed organic cotton fabrics.

The bio washing of organic cotton fabrics was done in the bath with the liquor ratio 1:15 with 3 gpl of Cellulase Enzyme using laboratory washing machine. The fabric was loaded into the bath at 450°C to 550°C for 10 minutes. The sample washing was repeated for 5 times and then, the samples were rinsed three times in de-ionized water. Finally, the samples were left to dry at room temperature for 24 hours.

Evaluation of color fastness

Colorfastness to washing: Wash fastness of all dyed samples was measured by the ISO 105-C03 testing method. Dyed samples were taken, stitched with one of the shorter side of the adjacent bleached fabric and was put to the bath containing 3 gpl of soap, 2 gpl of sodium carbonate and 1:30 MLR ratio at 60°C for 30 minutes. Then the specimen was washed with hot water, cold water and then it was dried. Then the dried fabrics were evaluated for color change and staining using grey scale.

Colorfastness to rubbing: Rubbing fastness of all dyed samples was measured by dry and wet rubbing method. The dyed sample was fastened to the flat base of the crock meter and the bleached 100% cotton measuring 5 cm×5 cm was mounted on the rubbing finger. After mounting the samples, the handle was rotated to ten complete turns at the rate of one turn per second to slide the covered finger back and forth twenty times. Then both the dyed and bleached fabric was evaluated with the grey scale for color change and staining.

Colorfastness to sunlight: Sunlight fastnesses of all dyed samples were exposed to sun for a period of time and then compared with an unexposed sample. A sample size of 35 cm×12 cm was cut from dyed organic cotton fabrics. The sample was divided into nine equal parts and marking was made on it. The strip was covered with a black chart papers, marked with equal number of divisions. First division was cut and exposed on sun light. The second division was cut and exposed on sun light and so on. Finally the first division after exposure for seven days was assessed for colour change in comparison with the original using a grey scale rating.

Results and Discussion

Colour fastness to washing

Colour fastness to washing of Eclipta, *Achras Zapota* and *Nyctanthes Arbortristis* dyed organic cotton fabric is shown in the Table 1b. It is found that the dyed sample shows good colour fastness.

Colour fastness to rubbing

Colour fastness to rubbing of Eclipta, *Achras Zapota* and *Nyctanthes Arbortristis* dyed organic cotton fabric is shown in Table 2. It is found that the dyed sample shows good colour fastness.

Colour fastness to sun light

Colour fastness to Sunlight of Eclipta, *Achras Zapota* and *Nyctanthes Arbortristis* dyed Organic cotton fabric is shown in Table 3. It is found that the colour fastness to sunlight of dyed Eclipta, *Achras Zapota* and *Nyctanthes Arbortristis* performed to be best.

Conclusion

Organic cotton is an eco-friendly fiber that suits for children wear. The natural dyeing is carried out in yarn stage to enhance the durability of dyeing. Then bio wash is given to soften the fabric.

The scouring and bleaching process was carried out onto the organic cotton yarn. Then the organic cotton yarn is dyed with natural dyes without adding mordant and chemicals. The dyed organic cotton yarn is woven into plain weave structure in handloom weaving machine. The bio washing process is carried over the dyed organic cotton fabric.

Natural dyeing eliminates the harmful effect of dye powder and prevents the skin from allergies and rashes. It is found that all the three Natural dyed organic cotton fabric shows good in color fastness to Washing, Rubbing and Sunlight.

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Page 4 of 4

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