Dyeing of Cotton Fabric with Eucalyptus and Betel Leaf Dye and Screen Printing

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Abstract - Natural dyeing is a technique to dye the textile fabrics with the colours extracted from natural sources like plant animals and minerals etc. Natural dyeing and printing have been used for centuries but the disadvantage of being limited in colours and inferior in colour fastness and durability properties. Nevertheless, they are eco-friendly, biodegradable and non- carcinogenic in comparison to synthetic dyes. In this research work cotton fabrics were dyed using the powder extract obtained from eucalyptus and betel leaves; simultaneous mordanting by alum, catechu, malachite green ,essentially higher utilization of dyestuffs and shortening of the dyeing procedure was achieved as a result of the dip dyeing principle followed prior to drying shows green colour. The dye exploitation of cotton is higher in this case common exhaustion method is followed. After drying it under taken to screen print cotton fabric with hibiscus flower dye extract using natural binding agent i.e. gum acacia. The result revealed that the cotton fabric can successfully done natural dyeing and screen printing with natural dye and natural binding agent.

Keywords: Natural dye, eco-friendly, mordant, cotton, screen printing, and natural binding.

I. INTRODUCTION

India has rich biodiversity and a wealth of useful germplasm resources, and the plant kingdom is undoubtedly a treasure house of a variety of natural products. Dyes are one of the most important uses of plants.(1) The use of natural dyes for textile dyeing has largely decreased following the innovation of synthetic dyes in 1856 (2). Until the latter part of the 19th century, people used natural colors (3) to color the textile fiber following the invention of synthetic colours. Research has shown that synthetic colours, which are allergic, carcinogenic and harmful to human health, are suspected of releasing harmful chemicals. Natural colors are environmentally friendly, on the other hand.(4) Although coloring has been accidentally discovered, its use has become so much part of the customs of man that it is hard to imagine a modern world without coloring.(5). In order for natural colors to be used successfully on a commercial scale, the appropriate and standardized techniques must be adopted properly. (6) The present study has attempted to investigate the possibility of dyeing cotton fabric by continuous dyeing with Eucalyptus extracts and betel leaf dye using various dyeing auxiliaries.

Methodology, Materials and Methods:

Materials: Cotton fabrics **,**Eucalyptus leaf Camaldulensis **,**Betel leaf Piper betel.

Methods:

The dyeing of the cotton clothes was basically done in four stages; pre-treatment, extraction of dyes from leave's, mordanting and dyeing.

II. PREPARATION OF FABRIC FOR DYEING

SCOURING

The natural method of scouring fabric was to boil well with a soap seed for several hours. When scouring has been completed, remove the tissue and rinse it in warm water and dry it in sunlight, iron it for the evenness of the color before dying. This study used water to extract substances from hulls of soap nut fruits to remove waxes in cotton scouring process.(7) The results showed that waxes can be removed in the scoring process of cotton. The cotton fabric absorbed water in 5 seconds at 40 percent of the substance powder by fabric weight.

EXTRACTION OF DYE:

The betel and eucalyptus leaves were dried shade and mixed separately by a mixing machine. The mixed quantity of each plant was then divided into three equal parts, which could be dissolved into 50% methanol and 50% water. However, all extraction samples were heated for 1 hour at the temperature in the water bath depending on the boiling point of the solvents used. Solvents used Boiling Temp (° C) Temperature Extraction (° C) Water 100 80 Methanol

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78.3 60 At the end of 1 hour, all the extraction samples were kept at room temperature for 24 hours for further color extraction. After 24 hours, they were all stressed when nearly all color components were extracted. Then the strained solutions were double filtered to obtain dye extracts. The solvent (Methanol) were removed by heating at their boiling point (b.p.) (Methanol b.p-78.3°C). Soxhlet appliances[7,8] could recover the amount of methanol. It was filtered and then kept dye solution for mordanting with malachite.

Table 1 Extraction Temperature.

Solvents used	Boiling Temp (°C)	Extraction Temperature (°C)
Water	100	80
Methanol	78.3	60

Mordanting:

To study the effect of dye shade of the eucalyptus and betel leaf extraction, alum, catechu, and malachite mordant were chosen. In this research simultaneous mordanting method was used 60gms of mordents were added to each litter of dye solution. Mix the mordant well in the dye bath and filter it for more than 5 times. Treatment of mordanting was carried out for 60 minutes at 100°C temperature with M: L ratio 1: 20. The wet fabric was then immersed in the dye solution at room temperature for 1 hour. Then the samples were washed in 1 Gms per liter of the soaping agent for 5min and dried.

Dyeing :

Experiments were performed in each dyeing was done at 30±20°C and for 30 min.

Screen printing:

Screen printing was introduced in the late 9th century as a traditional way of printing. The technology is used in a variety of materials, including textiles, ceramics, glass, polyethylene, polypropylene, paper, metal and wood. Other processes such as hand block printing, graved roller printing, heat transfer printing and inkjet printing are often preferred because it is a low cost and easy process. This printing technique imposes a design on a fine mesh screen, which contains blank areas covered with an impermeable substance. The ink is then forced to the printing square through the mesh by moving a squeegee over the mesh. A polyester mesh, 90 T monofilament, with a sieve thickness of 110 µm and a sieve opening of 45 % was used in this study. The type of printing was a square with dimensions of 6 by 6 cm.

Selection of natural dye and binder for printing:

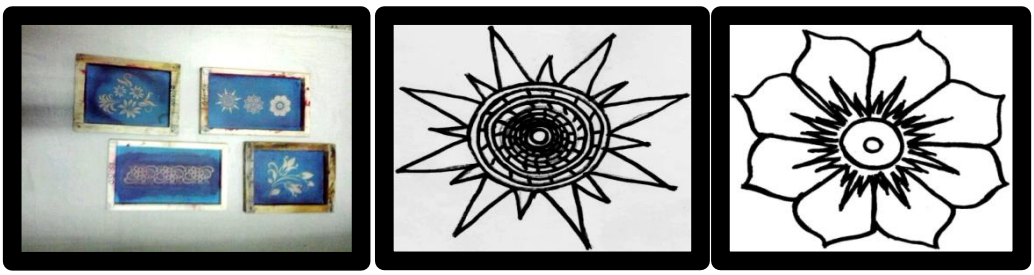
Hibiscus Malvaceae, Gum acacia

Preparation of printing paste

Formerly colors were always prepared for printing by collecting the hibiscus flowers, and grind it to make a paste, mix require amount of water and filter it to get the extraction. Then the gum Arabic was boiled with water to make a paste, which acts as a binder, and in the mean while add the natural dye extraction with the boiling binder stirrer it well, when it come to the water form, allow it to cool after some time use the paste for the dying purpose through screen to produce design on the fabric.

SCREEN **SELECTION OF DESIGN**

Plate-1 **Plate-2**



Nomenclature

Table-2

S. No	SAMPLE	DESCRIPTION
1	CO	ORIGINAL COTTON
2	CDAL	COTTON DYED ALUM
3	CDCA	COTTON DYED CATACHU
4	CDMA	COTTON DYED MALACHITE
5	CDALP	COTTON DYED ALUM PRINTED
6	CDCAP	COTTON DYED CATACHU PRINTED
7	CDMAP	COTTON DYED MALACHITE PRINTED

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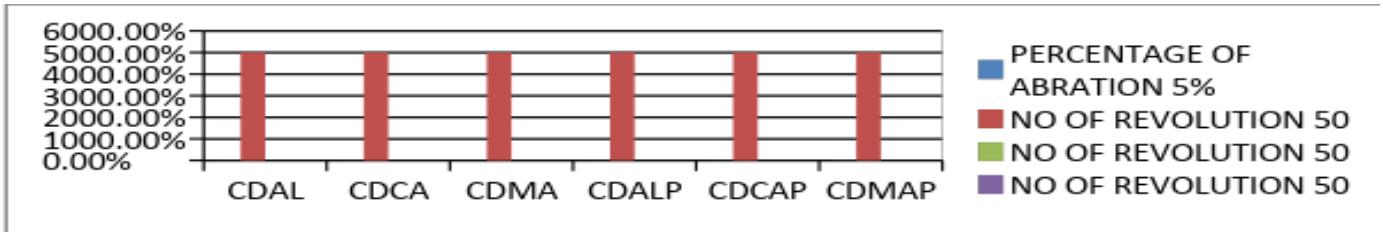
III. RESULTS AND DISCUSSION

Physical evaluation of gray and dyed fabrics

Tensile strength

Figure-1



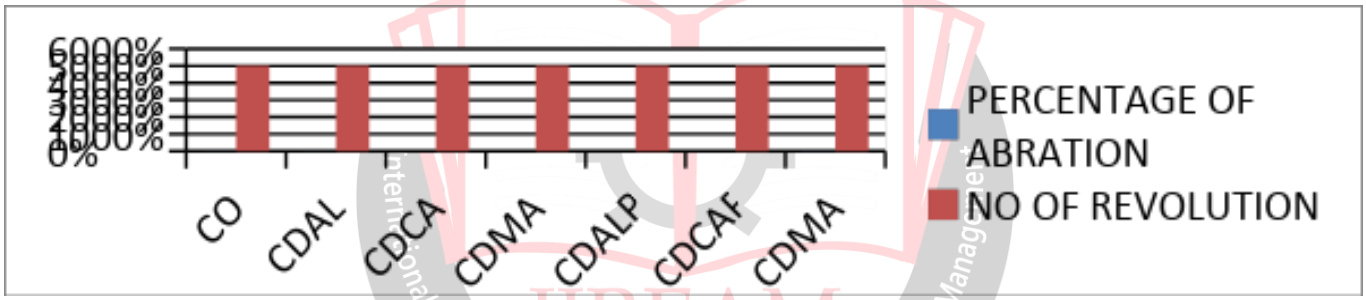
WARP

The above figure-1 shows that the cotton dyed and printed sample CDMAP 27 kg having high load and CDALP 22 cm having high elongation in warp direction and CDALP 25 kg having low load and CDMAP 20 cm are having low elongation in warp direction when compared to dyed and printed sample CDCAP.

WEFT

The above figure-1 shows that the cotton dyed and printed sample CDMAP 30 kg having high load and CDALP 26 cm having high elongation in weft direction and CDALP 25 kg having low load and CDMAP 20 cm are having low elongation in weft direction when compared to dyed and printed sample CDCAP.

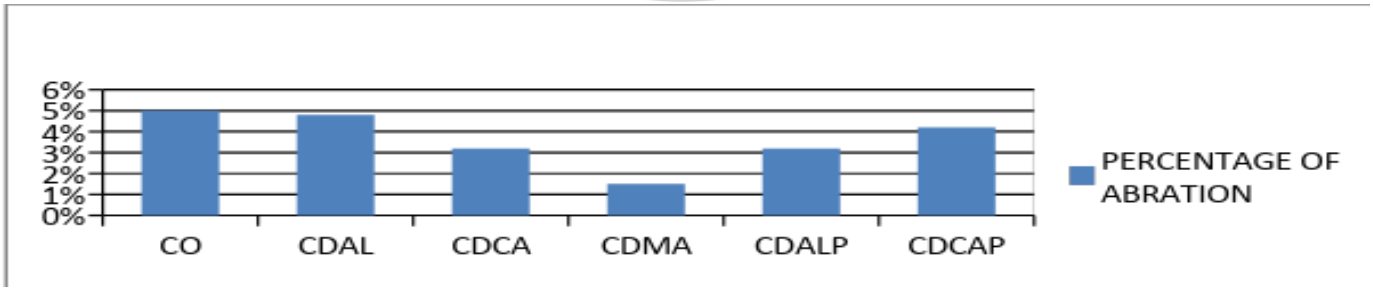
Abrasion resistance Figure-2



The above figure-2 shows that the dyed and printed cotton sample CDMAP having 10.4% high abrasion resistance and CDALP having 3.2% low abrasion resistance when compared to dyed sample CDCAP.

Colour fastness to sunlight

Figure - 3



The above figure-3 shows that the samples CCA, CMA, CMAP, are having excellent colour fastness property to sunlight in dry condition, the samples CAL, CALP, CCAP, are having very good colour fastness property to sunlight in dry condition.

Guide for ratings

5–Excellent, 4 – Very Good, 3 – Good, 2 – Fair1 – Poor

Colour fastness to rubbing (crocking)

Figure- 4

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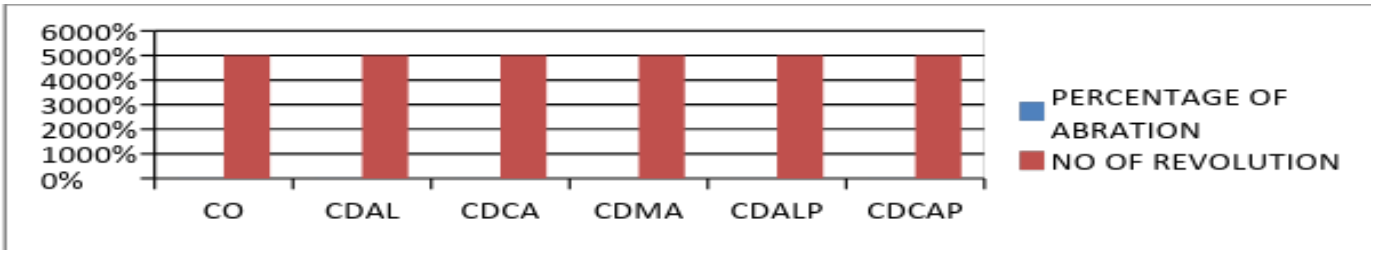


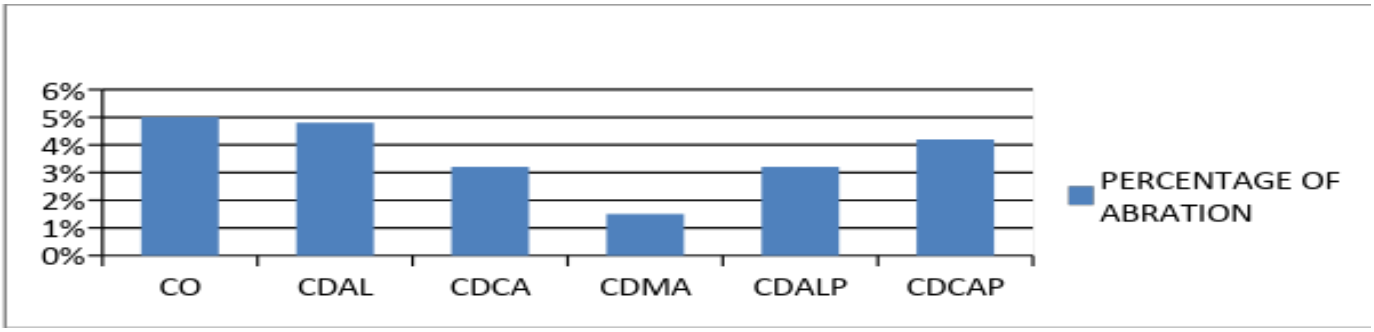
The above figure-4 shows that the samples CCA, CMA, are having excellent rubbing colour fastness property, In dry condition, the samples CAL, CALP, CCAP, are having very good rubbing colour fastness property In dry condition. The samples CMAP, are having excellent colour fastness property in wet condition. and the samples CMA, CAL, are having very good colour fastness property in wet condition and the samples CCAP, are having good colour fastness property in wet condition.

Guide for ratings

5 – Excellent, 4 – Very Good, 3 – Good, 2 – Fair, 1 – Poor

Colour fastness to laundering

Figure-5



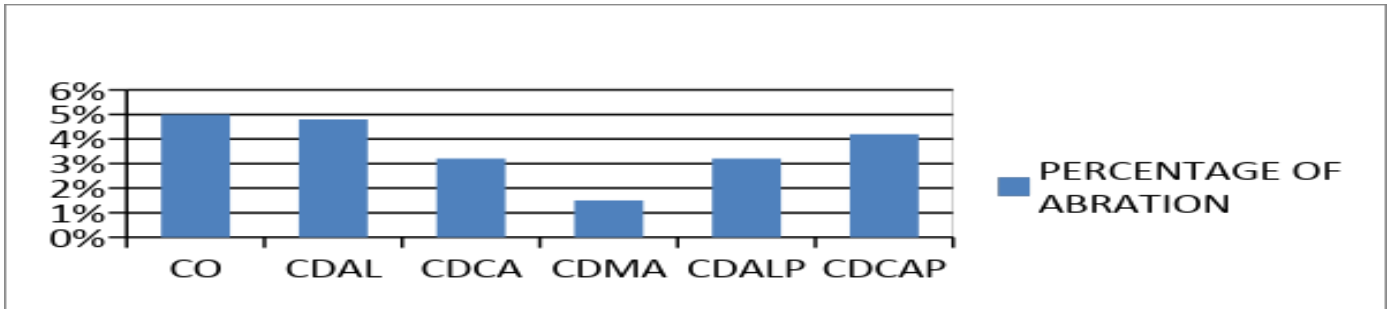
The above figure-5 shows that the samples CAL, CMAP, are having excellent colour fastness property in laundering and the sample CCA, CCAP, are having very good colour fastness property in laundering. The sample CMA, CALP are having good colour fastness property in laundering. The rating can be calculated by means of using grey scale.

Guide for ratings

5 – Excellent, 4 – Very Good, 3 – Good, 2 – Fair, 1 – Poor

Colour fastness to laundering

Figure-5



The above figure-5 shows that the samples CAL, CMAP, are having excellent colour fastness property in laundering and the sample CCA, CCAP, are having very good colour fastness property in laundering. The sample CMA, CALP are having good colour fastness property in laundering. The rating can be calculated by means of using grey scale.

Guide for ratings

5 – Excellent, 4 – Very Good, 3 – Good, 2 – Fair, 1 – Poor.

Evaluation through visual inspection

Visual appearance of the garment

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Figure-6

Gray Fabric **Dyed and Printed Fabric**

The above figure-6 shows that the 78% of faculty members and 76% of fashion designing students have rated the visual appearance of the garment for cotton dyed and printed fabric as excellent and 11% of faculty members and 10% fashion designing students have rated the visual appearance of the garment for cotton dyed fabric as very good. The same group of respondents 10% of faculty members and 3% fashion designing students has rated the visual appearance of the garment for cotton dyed and printed garment as fair and no one has rated poor or very poor

IV. CONCLUSION

The current scenario focuses more on the use of the wide range of natural resources of color pigments for use in food, pharmaceutical and textile materials instead of their synthetic counterparts. This trend aims to protect human health and also to protect and prolong life on Earth. Therefore, if natural colors are to be marketed, they must conform to the same stringent performance standards that are applied to synthetic colors. Consequently, much more research and development needs to be done in this area.

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