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Eco-Printing: Domestic technique of textile printing using the leaves of *Rose Indica*

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ABSTRACT
Clothing is one of the basic needs of human being; it has many functions like protection, identification, modesty, status and adornment. Human beings always loved to adorn their body and clothes by various techniques of value addition. Printing their clothes with colours are one of them. There are many printing techniques which can be used to print the clothes at domestic level like block printing, screen printing, stencil printing, hand printing etc. One of the latest techniques is eco printing. It is a technique of printing clothes by putting various parts of plants into the layers of fabric and steaming them for specific time period. Rose Indica (Rose flower) have many medicinal property, petal of rose flower is used in various edible and cosmetic products, but almost in all cases the leaves of this plant is discarded. In this experimental study an effort has been made to develop botanic print of rose leaves on silk and cotton fabric, standardizing the process and testing the colourfastness of the prints. Developed prints were tested for colourfastness to washing, dry cleaning, perspiration, rubbing, and sunlight exposure by following various ISO and AATCC standards, as no harmful chemicals were used, the developed products are also considered as eco-friendly. Results shows that the rose leaves printed cotton fabric develop clear print on fabric with bright colours; it also produces excellent colour fastness to washing, perspiration, dry cleaning and crocking but it exhibit poor colourfastness to exposure to sunlight.
Keywords— Eco-Printing, Rose Indica, ISO-Standards, AATCC Standards, Eco-Friendly

1. Introduction

Clothing is one of the basic need of human being after food and shelter and are an essential to protect the body [1]. Human beings cherish to embellish their clothes by various techniques. Printing is one of those techniques. It is believed that the oldest printed textile that is survived till the date belonged to China and dated back to 220 BCE. In other studies it was also documented that the earliest dyed clothes was found in Indus Valley civilization in around 3000 BCE [2]. Hence, embellishing the clothes through printing is not a new technique. Textile printing can also done by oneself in domestic level for which many techniques are popular like block printing, screen printing, hand printing, stencil printing etc. One of the latest and eco-friendly technique is eco-printing.

Eco printing is a method of printing the textile material with the help of various parts of plant. In this technique, pigments available in different parts of plants are extracted directly on fabric to develop print over it. There are two popular methods of eco-printing which are practiced by masses, namely- Bind and steam technique & Hammering or Pounding technique. In bind and steam technique, various parts of plants are bind between the layer of fabric and then steam to achieve the print whereas in hammering or pounding technique the plant material is firstly beaten by soft hammer over the fabric layer then the fabric is wrapped and steamed to develop the print.

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2. Materials and Methods

2.1 Fabric

In this study 2 different types of fabrics were used. A 100% cambric cotton fabric with the thickness of 0.25 mm and silk fabric with the thickness of 0.09 mm. *Paramount thickness tester* was used to test the thickness of the fabrics.

2.2 Plant

Leaves of *Rose Indica;* the Indian rose were used as printing substance in this study. Petals of rose flowers are used in making of many edible and cosmetic products like rose-water, gulkand, gul-rogan, rose oil, perfumes, medicines, syrups, beauty products etc. but the leaves of the plants are discarded in almost every product. In this study an attempt has been made to use those discarded leaves of Indian rose flower in printing of textile.

2.3 Mordant

Potassium Aluminium Sulphate, commonly known as Alum, was used as a print fixer in pre and post mordanting process of the textile material, as this metal salt found in abundant amount on earth it is easily accessible and are affordable in price. This salt is also considered as safe mordant while printing. Aluminium ions shown great affinity with cellulosic and protein fibers both and act as a bridge between various dye molecules and fibers [3].

3. Procedure

3.1 Scouring

Two type of fabric were used in this study in which the cellulosic cotton was coded as AL-05-RL-C whereas silk fabric which is protein in nature is coded as AL-05-RL-S. Both samples were scoured a night before the experiment with common detergent. After scouring the weight of both samples was measured. The weight of A4 sized AL-05-RL-C was 6.385 gm. and A4 sized Al-05-RL-S is of 2.309 gm.

3.2 Calculation of MLR

To improve the colour fastness of print proper fixation of print is mandatory. MLR (Material to liquor ratio) calculation is needed for preparing a standard mordant solution. It is calculated by adding 20% of alum of fabric weight into 1:50 MLR water of fabric weight.

3.3 Preparation of Mordant

Two alum solutions are required for pre and post mordanting in both sample. As the weight of AL-05-RL-C was 6.385gm the alum requirement is 1.277 gm. and MLR is 319.25ml and 2.309 gm. weighted AL-05-RL-S requires 0.461 gm. alum which dilutes into 115.45 ml water.

3.4 Pre Mordanting of Samples

After scouring the next step of the pre-treatment is pre-mordanting of the samples, which is done by soaking both the samples into their respective alum solution for about 15 minutes. After pre mordanting, the samples were taken out and were gently squeezed to remove extra solution, and rest of the solution is discarded.

3.5 Arrangement of leaves

After pre mordanting, the collected leaves of *Rose Indica* (rose) were washed and arranged over the pre-treated fabric layer in a way in which the front of the rose leaves were faced on the front of the fabric layer (Fig.1).

Fig.1. Arrangement of plant leaves on fabric surface.

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3.6 Hammering or Pounding of the Plant Material

In this experimental study the Hammering or Pounding technique was used to develop the botanic print. The layer of butter paper was spread over the leaves arrangement to protect the prints from overlapping with each other and hammered with soft hammer till the colouring substance of all part of the leaves came out and print become visible (Fig. 2). Care should be taken during the hammering process, as harsh strokes of hammer can torn the butter paper and fabric sample both.

Fig. 2. Beaten leaves

3.7 Binding the Samples

Wooden sticks were used to wrap the fabric samples and making rolls of it. After wrapping, these fabric bundles were tied with cotton thread tightly (Fig. 3).

Fig.3. Fabric bundles wrapped over wooden sticks

3.8 Steaming of Samples

Steaming process is used for the fixation of the print. The samples were placed in a steaming pot, over the stainless steel stand for specific time period. Sample code AL-05-RL-C was steamed for about one and half an hour whereas sample code AL-05-RL-S was steamed for an hour according to the fabric type (Fig 4).

Fig.4. Fabric rolls in steamer

3.9 Removal of Plant Substances

After steaming process, the samples were taken out from steamer and keep the fabric for drying at room temperature till the outer layer of the fabric samples seems dry. After the drying process, the fabric bundles were opened and the leaves and butter paper were removed and discarded.

3.10 Post Mordanting of Samples

After removing leaf particles the samples were again dipped into their corresponding alum solution with the previously used concentration for about 15 minutes for the post mordanting process (Fig. 5).

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Fig.5. Fabric dipped in alum solution for post mordanting process

3.11 Drying of Samples

After 15 minutes, samples were taken out from mordant solutions, excess mordant solution from the samples was squeezed softly and samples were kept for drying in flat surface in room temperature.

3.12 Testing

After the whole experimental process the sample were kept for about 15 days in dark and dry place for the fixation of the colours. After fortnight, the samples were washed with fresh tap water, dried and then shortlisted by the visual test which was performed by conducting a survey among 100 persons, in which sample AL-05-RL-C was selected and sample AL-05-RL-S was rejected by the majority. After this, sample AL-05-RL-C was send for the testing in Northern India Textile Research Association (NITRA) for the colourfastness of developed print to Dry Cleaning, Colourfastness to Washing and Colourfastness to Perspiration (acidic and Alkaline both medium). Further tests like Colourfastness to Exposure to Sunlight, Colourfastness to Crocking (dry and wet both) were conducted in the textile testing laboratory of Department of Family and Community Sciences, University of Allahabad by following various ISO and AATCC standards.

4. Testing Standard Applied

4.1 Colourfastness to Dry Cleaning

ISO 105 D01: 2010: Colour fastness to drycleaning using perchloroethylene solvent [4].

4.2 Colourfastness to Washing

ISO 105 C06 A1S: 2010 (400C): Colour fastness to domestic and commercial laundering [5].

4.3 Colourfastness to Perspiration

ISO 105-E04: 2013: Colour fastness to perspiration [6].

4.4 Colourfastness to Sunlight

ISO 105-B01: Colour fastness to light: Daylight [7].

4.5 Colourfastness to Crocking

AATCC 8-2016e: Colorfastness to Crocking: Crockmeter method [8].

5. Results and Discussion

In this study an effort has been made to develop botanic print of rose indica over cotton and silk fabric, in which it is discovered that the cotton fabric coded as AL-05-RL-C developed clear print all over the fabric (Fig. 6) whereas silk fabric coded as AL-05-RL-S developed distorted print over the fabric (Fig. 7), it is presumed that the reason behind this is silk fabric's poor absorbency properties as well as alum react better with cotton as compared to silk. In the visual test of both samples, sample code AL-05-RL-C was selected by the population so it was send for the colourfastness tests where it exhibit good colourfastness to dry-cleaning, washing, perspiration and crocking by achieving 4-5 in gray scale in each test but they produces average colourfastness to sunlight by scoring 3 in gray scale.

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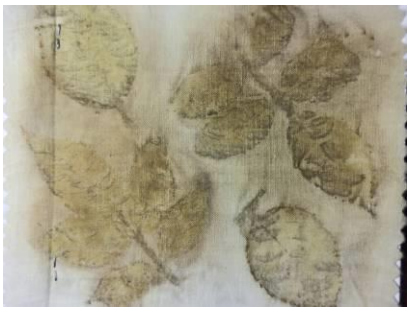

Fig.6. Print of Rose Indica on AL-05-RL-C

Fig.7. Print of Rose Indica on AL-05-RL-S

Table.8. The test report of Sample code- AL-05-RL-C issued by Northern India Textile Research Association (NITRA) (Report no- 1046E/22-CQE)

S.No.	**Test Parameter**	Test Method	Unit	**Test Results SC:2030**
1	**Colour Fastness to Dry Cleaning** **– Change in Colour** **– Staining on Wool** **– Staining on Acrylic** **– Staining on Polyester** **– Staining on Nylon** **– Staining on Cotton** **– Staining on Acetate**	ISO 105 D01 :2010	Grade	 **4-5** **4-5** **4-5** **4-5** **4-5** **4-5** **4-5**
2	**Colour Fastness to Washing** **– Change in Colour** **– Staining on Wool** **– Staining on Acrylic** **– Staining on Polyester** **– Staining on Nylon** **– Staining on Cotton** **– Staining on Acetate**	ISO 105 C06 A1S: 2010 (40^0C)	Grade	 **4-5** **4-5** **4-5** **4-5** **4-5** **4-5** **4-5**
3	**Colour Fastness to Perspiration** **– Change in Colour** **– Staining on Wool** **– Staining on Acrylic** **– Staining on Polyester** **– Staining on Nylon** **– Staining on Cotton** **– Staining on Acetate**	ISO 105-E04: 2013	Grade	 **4-5** **4-5** **4-5** **4-5** **4-5** **4-5** **4-5**

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CONCLUSION

Eco printing on textile material is not a new method for embellish clothing; it is an easy, applicable and affordable technique of textile printing, which can easily adopted at home. There are multiple methods, plants, mordants and fabrics that can be used in this technique to achieve the prints but the major drawback is the colourfastness property, there is no written data was available which assure or examine the colourfastness property of eco prints. To overcome and standardized the process, pre and post mordanting of the samples were applied. In the study it is documented that when AL-05-RL-C and AL-05-RL-S were soaked in alum solution for post mordanting of the samples, it improves the colourfastness of AL-05-RL-C and obtained results of various ISO and AATCC tests standards also assures the colourfastness of the print. It can be concluded that eco printing is an easy and economic method to print textile at domestic level and application of alum for pre and post mordanting improves the colourfastness of the textiles too.

Acknowledgement

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