YRF Summary Report

Development of Patterns from Nature through Contact Dyeing/Printing

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Introduction

According to the elements cycle, the chemicals present in synthetic dyeing, transfer from soil to plants to the animal to humans and on using these substances regularly are accumulated in the underground waters, air, and soil which harm human and ecology. Hence it becomes evident that the green chemical approach is given to the textile industry and thus came in the new era of natural dyes. The colourants present in natural dyes are obtained from animal, vegetable or mineral matter without chemical processing. Despite all the practical disadvantages, the use of natural dyes has found itself well-rooted in the textile industry **(Lellis et a., 2019)**.

The present study was undertaken to produce natural random patterns using marigold flowers on cotton and silk fabric following the contact dyeing/printing method. This method is an alternative and more sustainable method for natural dyeing using natural mordants which has the potential for reducing wastewater and requires less equipment. In this method, random and complex patterns are produced using organic waste, plant leaves and flowers. Contact dyeing/printing using natural dyes is still very limited, due to poor colourfastness, colour strength and lack of standard colour retention.

In this study, the marigold flowers were used to create eco-prints on cotton and silk fabrics. Alum, Vinegar and Iron mordants of different concentrations and treatment times were applied to improve the colour strength (K/S) and colourfastness of naturally dyed/printed fabrics.

Methodology

Commercially available cotton and silk fabric were bundled with marigold flower petals individually, immersed in naturally prepared iron mordant. To create natural patterns, one part of the prepared bundles of cotton and silk were steamed for 1 hour, 1.5 hours and 2 hours and the other part were boiled for 15 minutes, 30 minutes and 45 minutes.

Eco-printed/dyed cotton and silk fabrics were post-mordanted with varying concentration of aluminium potassium sulphate – 5%, 10%, 15%, and natural white vinegar - 1%, 3% 5%. On this background, the effect of boiling, steaming time as well as the concentration of mordants on colour strength (K/S) and colourfastness properties were studied with standard procedures. Different products like silk scarves and cotton cushion covers were also produced.

Data Analysis and Results

Cotton and silk both fabrics have different characteristics. Vinegar and potassium aluminium sulphate both have different chemical compositions, so they influenced the colour strength and colourfastness properties of cotton and silk fabrics differently.

The effect of varying boiling and steaming time and constant mordanting concentration on colour properties was studied. The Colour strength of cotton and silk fabrics increased markedly on increasing the boiling and steaming time. The Colourfastness properties of both the fabrics were also found to improve. The influence of boiling and steaming time on the colour strength of eco-printed silk fabric was noted slightly well than cotton fabric. The

increase in colour strength in silk fabric was due to the presence of multiple functional groups like -OH, $-SO_3H$, -COOH, $-C_6H_5OH$, $-NH_2$. These reactive groups are helpful for the good dyeing and k/s values in silk **(Jeyaraj et al., 2015).**

Cotton fabrics eco-printed through boiling and steaming method were evaluated with increased colour strength (K/S) when post–mordanted with alum 5% as compared to 1% vinegar. In the case of silk fabric, similar results were found on post-mordanting with 5% alum and 1% vinegar. These mordanted cotton and silk fabrics presented improved colourfastness properties compared to the control sample.

The effect of varying mordant concentration and constant boiling and steaming time of eco-printing on colour properties was also studied. Cotton and silk both fabrics have exhibited decreased K/S value on increasing the concentration of mordants. These fabrics showcased better K/S value on 5% alum and 1% vinegar treatment in both the cases of contact dye/printing techniques boiling-45 minutes and steaming -2 hours. Much difference was not seen in colourfastness properties of cotton and silk fabrics, post-mordanted with increased concentration of mordants- alum and vinegar.

Conclusion

The combination of boiling and steaming technique for contact printing and mordant concentrations showed good colour strength (K/S) and colourfastness properties in cotton and silk fabrics, were used to produce different products. Marigold flower natural prints were developed on silk scarves as well as on cotton fabric cushion covers. Fashion accessories, handbags, pouches/clutches and other useful products can also be designed.

Suggestion/Recommendations:

1. Similar study can be done with other flowers/leaves and mordants.
2. A similar study can be tried with other mordanting procedures.
3. Many different products such as garments, fashion accessories, handbags/ pouches/ clutches and like can be developed.

Plate 1: Preparation of fabric samples for contact printing

Plate 2- Marigold petal sprinkled over the fabric and bundle preparation

Plate 3- Boiling and steaming

Plate 4- Bundles after boiling and steaming

Plate 5- Eco-printed fabric samples

Plate 6- Marigold flower printed silk scarves

Plate 6- Marigold flower printed cotton cushion cover and block printed tissue papers