

A Comparative Study on Application of Natural Dyes Obtained from Purple Cabbage and Black Plum on Cotton and Silk Fabric

Sameera Riyaz¹

¹,M. Phil,Textiles and Clothing ,
Dept of Post Graduate Studies and Research in Home Science,
Justice Basheer Ahmed Sayeed College for Women
(Autonomous), Chennai , Tamilnadu-600018.

Dr. Ms. Shabiya Thaseen²

², Assistant Professor,
Textile Science and Fashion Designing,
Dept of Post Graduate Studies and Research in Home Science,
Justice Basheer Ahmed Sayeed College for Women
(Autonomous), Chennai ,Tamilnadu-600018.

Abstract - The concept of eco-friendly clothing is being increasingly adopted globally. The main purpose of this research was to compare and study the application of natural dyes obtained from Purple Cabbage and Black Plum on Cotton and Silk fabrics. After the dyeing process was carried out using an appropriate method of dye extraction with the suitable mordant and mordanting technique, the dyed fabrics were subjected to different parameters like visual evaluation on basis of general appearance, brilliance of color and evenness of color. The test to evaluate the color fastness properties were done by subjecting the samples to Sunlight, Laundering, Pressing, Crocking, Perspiration. The results were compared between two dyes. From the analysis of results, it is observed that both Purple Cabbage and Black Plum dye extracts on Cotton and Silk fabrics were found to be good in terms of all the tests of visual evaluation. On the basis of the color fastness properties, Cotton was found to excel with black plum dye extract and Silk seemed to be good with purple cabbage dye extract.

Keywords: Black Plum, Color fastness tests, Natural dyes, Purple Cabbage.

INTRODUCTION

Natural dyes are dyes or colorants derived from plants, invertebrates, or minerals. The majority of natural dyes are vegetable dyes from plant sources-roots, berries, bark, leaves, and wood and other organic sources such as fungi and lichens. The use of non-allergic, non-toxic and eco-friendly natural dyes on textiles has become a matter of significant importance due to the increased environmental awareness in order to avoid some hazardous synthetic dyes which produce skin allergy, toxic wastes and other harmfulness to human body. Cotton and silk fabrics were chosen for the study as they are one of the world's most popular natural fibres that inherent affinity for dyes. Creating a Red Cabbage dye vat, can produce differing results on protein fibers depending on the pH of the dye bath. The black plum fruits are edible oblong berries, deep violet or bluish in color with pinkish pulp, having various medicinal properties and used in Ayurveda as a stomachic, astringent, antiscorbutic, diuretic and antidiabetic .Colorfastness is defined by the American Association of Textile Chemists and Colorists as "the resistance of a material to change in any of its color characteristics, to transfer its colorant(s) to adjacent materials, or both, as a result of the exposure of the material to any

environment that might be encountered during the processing, testing, storage, or use of the material." In other words, it is a fabric's ability to retain its color throughout its intended life cycle.

OBJECTIVES

- ❖ To optimize the conditions for extraction of the dye from the selected Purple Cabbage and Black Plum.
- ❖ To dye the cotton and silk fabric with selected natural dye extracts using natural mordant.
- ❖ To compare and evaluate the color fastness properties of cotton and silk fabrics dyed with two different natural dyes and subjecting them to color fastness tests with respect to Sunlight, Laundering, Pressing (Dry and Wet), Crocking (Dry and Wet) and Perspiration (Acid and Alkaline).

As in-sight into the literature and studies reveals that no comparative study has been done so far regarding comparison on application of natural dyes obtained from purple cabbage and black plum on cotton and silk fabrics .Hence, this study was undertaken to know about the influence of purple cabbage and black plum natural dyes on cotton and silk fabrics.

METHODOLOGY

This study deals with dyeing of natural fabrics like cotton and silk with natural dyes extracted from purple cabbage and black plum. Purple cabbage dye have a better biodegradability and higher than compatibility with the environment. Jamun or Black plum is associated with many health and medicinal benefits. Since it is used in medical field, dye extracted from this fruit cannot cause any problem when it is used as a dye. Alum is used as the natural mordant in dyeing with natural dyes. Alum most commonly used mordant and it's used for fixation of color, brightness and evenness the final color of cloth.

Dyeing Process

1. Weight of fresh purple cabbage and black plum : 2Kg
2. Mordanting Technique : Simultaneous Mordanting
3. M:L Ratio for dye extraction : 1:100
4. Weight of Mordant : 10 grams/ litre.
5. Temperature for dye extraction : 80°C to 100°C
6. M:L Ratio for dyeing : 1:50
7. Temperature for dyeing : 70°C to 80°C

Procedure of Dyeing

Usually the process of natural dyeing uses dried plant material to obtain color and reduce the weight of the plant material used, but in this study fresh cabbage and black plums were used as it yields a better color than the dried (generally dried purple cabbage gives a muted color or sometimes no color at all). The following steps were undertaken in process of extracting the dye solution.

- The vegetable is chopped into small pieces to give more surface area for color extraction and the black plum is nicely crushed. The plant material placed in a large non-reactive pot (like stainless steel or glass), should be filled with twice as much water as plant material.
- Simmer it for an hour or so, until you get a nice dark color. Strain out the plant material and return the liquid to the pot, measuring it according to the M:L ratio
- The measured amount of the mordant (Alum) should be dissolved in a small quantity of water, strained and should be added along with the dye solution in the pot. The dye solution should heat at the approximate given temperature.
- Pre-treated wet fabric is placed in the dye bath and brought to a slow boil.
- Fabric is worked well up and down with a rubber gloves or a stick so as the color of the dye can penetrate into the fabric evenly without forming any patches.
- Heat is turned off after an hour and fabric is allowed to sit in the warm water as long as needed. The fabrics were let in the dye solution while stirring it now and then for achieving even color. Darker hues can be achieved by allowing to sit longer, even overnight. When the required color is obtained the fabrics were taken out and washed with a soap solution.

- It will run the excess color. The materials were squeezed and wrung well to remove excess water and is dried in shade.

Statistical analysis

Co-relation and t -test was selected for the statistical analysis.

RESULTS AND DISCUSSIONS

Visual inspection was conducted to compare the general appearance, brilliance of color and evenness of color by a panel of twenty five judges. The tests for color fastness were assessed by subjecting the test samples to Sunlight for 5 days, laundering, pressing, crocking and perspiration. The results of all the above mentioned tests are evaluated and tabulated

I. Rating for Visual Inspection

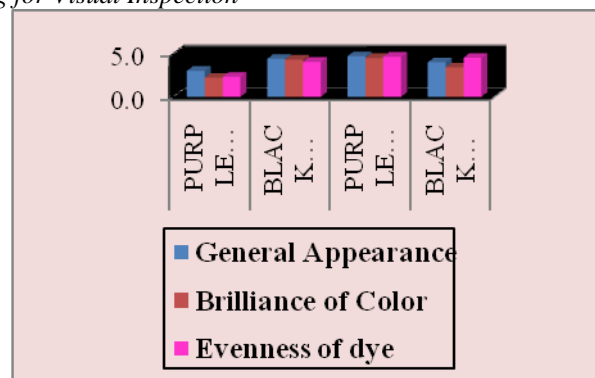


Figure 1

Guide for Spectrophotometer

- 5 - Excellent
- 4 - Very Good
- 3 - Good
- 2 - Fair
- 1 - Poor

Figure 1 indicates that the cotton fabric dyed with black plum dye and silk with the purple cabbage dye is rated good to excellent in terms of general appearance, brilliancy of color and evenness of dye in visual inspection.

II. COLOUR FASTNESS TESTS

Determining the color fastness properties, the Cotton and Silk samples dyed with natural dye extracts of Purple Cabbage and Black Plum showed good color fastness properties with respect to Sunlight, Laundering (30°C and 70°C), Pressing (Dry and Wet), Crocking (Dry and Wet) and Perspiration (Acid and Alkaline). It was found that Black Plum dye extract on Cotton and Purple Cabbage dye extract on Silk showed a remarkable performance on most of the color fastness tests.

COLOR FASTNESS TO DRY PRESSING

FABRICS	NATURAL DYES	COLOR CHANGE				COLOR TRANSFERENCE			
		Mean	SD	T-Value	P-Value	Mean	SD	T-Value	P-Value
COTTON	PURPLE CABBAGE	4.7	0.476	0.957	0.344	4.8	0.436	1.095	0.279
	BLACK PLUM	4.8	0.408			4.9	0.332		
SILK	PURPLE CABBAGE	4.8	0.408	0.76	0.451	4.9	0.332	0.400	0.691
	BLACK PLUM	4.9	0.332			4.8	0.374		

TABLE 1

GUIDELINES FOR RATING

- 5 - Excellent - Negligible rate of color change
- 4 - Very Good - Very little rate of color change
- 3 - Good - Little rate of color change
- 2 - Fair- Appreciable rate of color change
- 1 - Poor- Objectionable rate of color change

Table 1 indicates the mean, standard deviation and the p-value to find the rate of Significance in terms of color change and color transference of the dyed samples with the help of t-test.

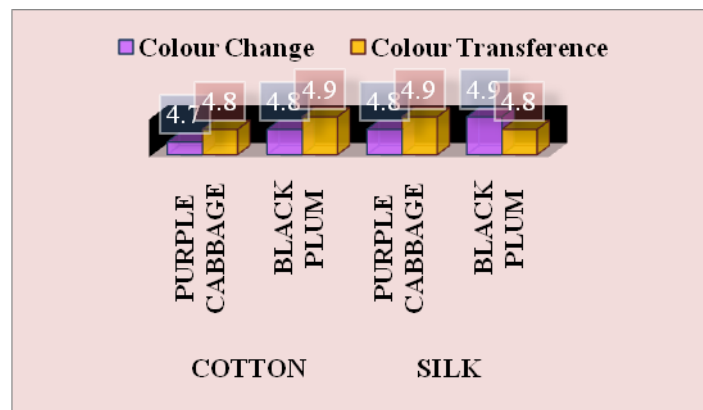


Figure 2

Color Fastness to Dry Pressing

Figure 2 indicates the average rating for color change of cotton fabric dyed with purple cabbage and black plum were found to be 4.7 and 4.8. For the silk fabric dyed with purple cabbage and black plum were 4.8 and 4.9 respectively. There was a very little rate of color change in both the dyed samples of Cotton and Silk. And to that of rating for color transference of cotton fabric dyed with purple cabbage and black plum were found to be 4.8 and 4.9. For the silk fabric dyed with purple cabbage and black plum were 4.9 and 4.8 respectively. There was very little to negligible rate of color change in both the dyed samples of Cotton and Silk. Both the fabrics proved to be very good to excellent in terms of fastness to dry pressing showing no color change or color transference on the piece of white fabric attached along with the sample.

CONCLUSION

From the study it can be concluded that the natural dyes from purple cabbage and black plum performed well on cotton and silk fabrics in various tests of color fastness.

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