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Silk Dyeing with Natural Dye Extracted from Spice

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Abstract: *Textile dyeing plays a very important role in textile processing industry. Finding of researches conducted in recent years showed that chemicals used in synthetic dyes may contain toxic elements such as benzidine, aryl amine, lead, cadmium, zinc, mercury, formaldehyde, pentachlorophenol and halogen carrier etc.. Use of such dyes in textiles is associated with environmental degradation as well as hazards on health of human and other living beings viz creating skin cancer, skin irritation, lungs problem and allergy. Due to such negative impact of synthetic dyes researches in the field of textile dyeing has been focused on substitute preparation of synthetic dyes. Dyes of natural origin are environment friendly in nature and have no side effect on skin. The present study deals with the extraction of natural dye from spice and its application on textile fabric. Dye was extracted in acidic medium. For improving dyeability of textile substrate, mordanting of the fabric was done with alum mordant. In experiment, pre, post and simultaneous mordanting techniques were used for mordanting of the fabric. Attempt has been made to investigate the overall colour fastness properties of dyed textile material.*

Keywords*:* natural dye, synthetic dye, dyeing, mordants, colour fastness, environment friendly.

INTRODUCTION

Nature expresses itself in a wide spectrum of colours all around us. The alchemy of colours started from an early time. Indians have been forerunners in the art of natural dyeing. The advent of synthetic dyes caused rapid decline in the use of natural dyes. [1] These synthetic dye stuffs produced hazardous by-products some of which possess carcinogenic intermediates and hence a ban has been imposed by Germany and some other European countries on the use of benzidine dyes in textile garments exported into their countries. [2] The interest in use of dyes and colours of natural plant sources for colouring textile, food and pharmaceutical and cosmetic products is increasing demand for plant origin of dyes particularly for textile application is due to consumer desire to replace synthetic chemical by natural compounds [3].

Skin demands safer textile products especially for babies and children as reported in the EU needs for qualified products.[4] the usage and production of natural dyes from plant sources has become better known due to growing awareness of the environment and health care.[5] Natural dyes are generally used in combination with mordants which have affinity for both colouring matter and the fibre, hence by combining them with the dye they form an insoluble precipitate on the fabric. [6]

With the help of mordants different colours and its tones can be obtained from a single dye source. Various studies have been carried out by different scientists on effect of mordants and mordanting techniques. It is reported that colour depth vary from mordant to mordant and mordanting technique to mordanting technique.[7] The present paper is primarily focused on the determination of the impact of mordanting method in colorfastness of natural dye obtained from byproduct of black cardamom .

MATERIALS

1. SOURCE: Peel of black cardamom was used as a source of natural dye.

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2. **SUBSTRATE:** Pure mulberry silk fabric was used as a textile material.

3. **CHEMICALS USED:** Alum or hydrated potassium aluminium sulfate (potassium alum) was used for mordanting while hydrochloric acid was used for preparation of acidic medium of dyeing.

4. **PROCUREMENT OF THE SAMPLE:** Silk fabric and black cardamom were procured from the market.

5. **LOCALE OF THE STUDY:** The study was conducted in the chemistry laboratory of Department of Home Science, University of Allahabad (U.P.).

METHODS

Preparation of dye powder: Black cardamom was dried in shade and peel was separated followed by grinding to make into fine powder. Dye powder was used for dyeing purpose.

Preparation of textile material: Degumming of silk was done by dipping it into 0.5 % of mild detergent solution having 50^0C temperature. It was stirred gently for 30 minutes. Silk fabrics of one gram weight of required number were prepared by weighing for experimentation.

Preparation of acidic medium: For preparation of acidic dye bath 1 ml of hydrochloric acid was added in 100 ml of distilled water.

Preparation of mordanting solution: Mordating solution was prepared by add 1gm of potassium alum in 100 ml of distilled water.

Dye extraction

Prepared dye powder was soaked in acidic medium and heated in a beaker kept over a water bath for quick extraction. It was then filtered. The extract was used keeping. M:L ratio as 1:100 for dyeing. The fabric was immerged in the filtered extract and it is dyed for one hour with continuous stirring. The samples were left immersed in the dye solution for 24 hours.

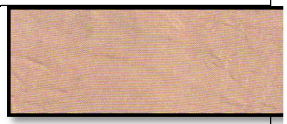
Mordanting of samples: The silk fabric was treated with alum mordant by following three methods:

- **Pre mordanting:** In this method samples were pretreated with the alum solution and then dyed with the dye extract.
- **Simultaneous mordanting:** In this method the samples were dyed with dye extract along with alum mordant.
- **Post mordanting:** In post mordanting the samples were dyed first and then treated with modanting solution.

After mordanting and dyeing, the fabrics were tested for colour fastness.

RESULTS AND DISCUSSION

Table 1: Colours obtained with different mordants using black cardamom dye

Dye Source	Mordant	Methods of Mordanting	Medium of Mordanting	Shades of Colour
Peel of black cardamom	Alum	Pre	Acidic	
		Simultaneous	Acidic	
		Post	Acidic	

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Colours of dyed silk samples

The different colours were developed by using different methods of mordanting i.e. pre post and simultaneous mordanting. Acidic and alkaline mediums were used for extraction of dye and application of dye on silk fabric. Obtained colours are listed in table 2.

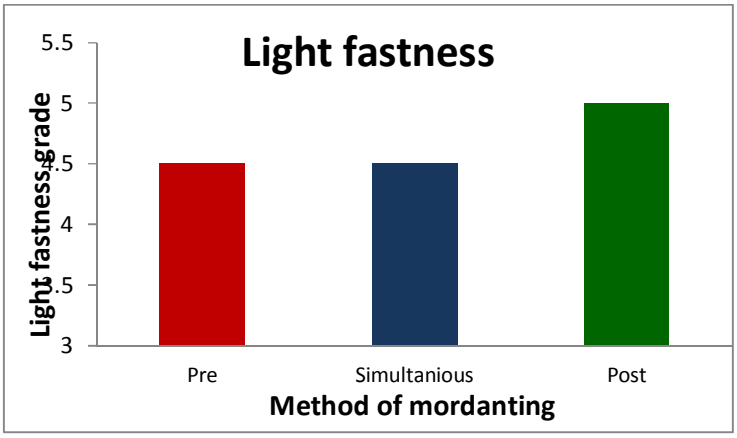
The results obtained are reported and discussed in the above section

COLOUR FASTNESS TESTS

Colour fastness to Light

In the colour fastness to light, the samples dyed with peel of black cardamom using mordant in acidic mediums, it was found that post mordanting improved fastness to light because the sample showed no colour fading and no change in colour. Light fastness rating was 4/5 for pre and simultaneous mordanted fabrics.

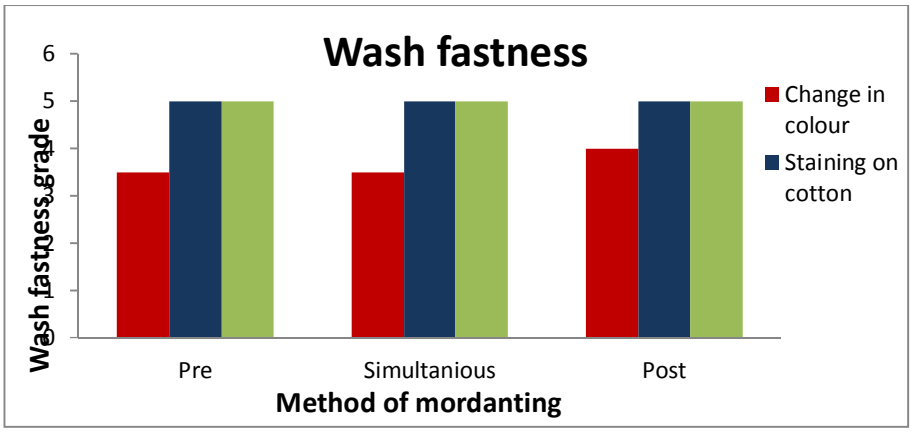
Graph 1



Colour fastness to washing

Graph 3 reveals that sample dyed with all the three mordanting methods results in good wash fastness. All the samples showed no fading and no staining on either of the adjacent fabrics (silk and cotton) but pre, simultaneous and post mordanted fabrics showed much change in colour i.e. 3/4, 3/4 and 4 respectively.

Graph 2



Colour fastness to crocking:

Overall, it can be concluded from the result that, dry crocking is better than wet crocking. Simultaneous and post mordanting were found excellent towards both dry and wet crocking. In wet crocking pre mordanted silk fabric showed slight change in colour (4/5).

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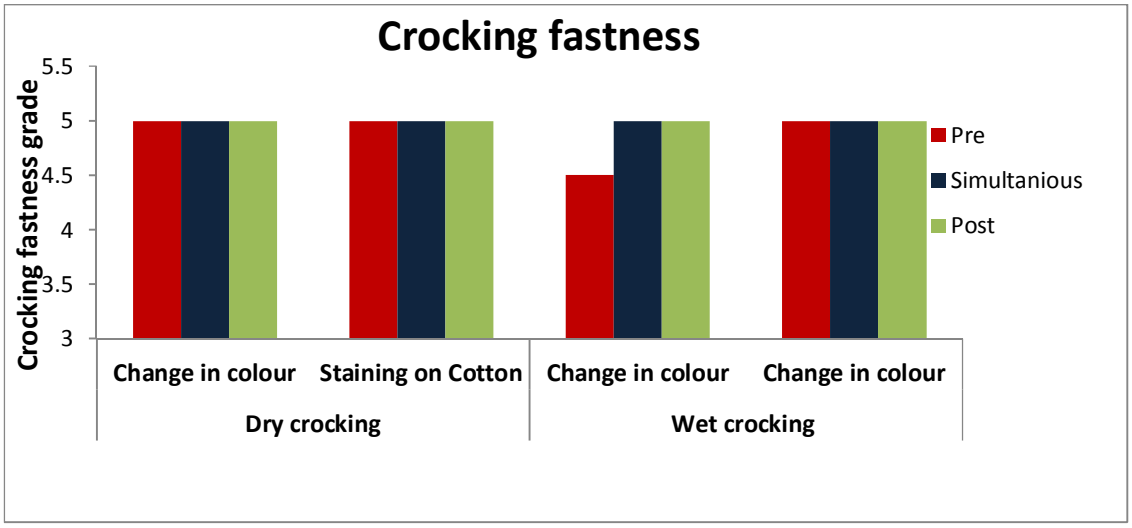
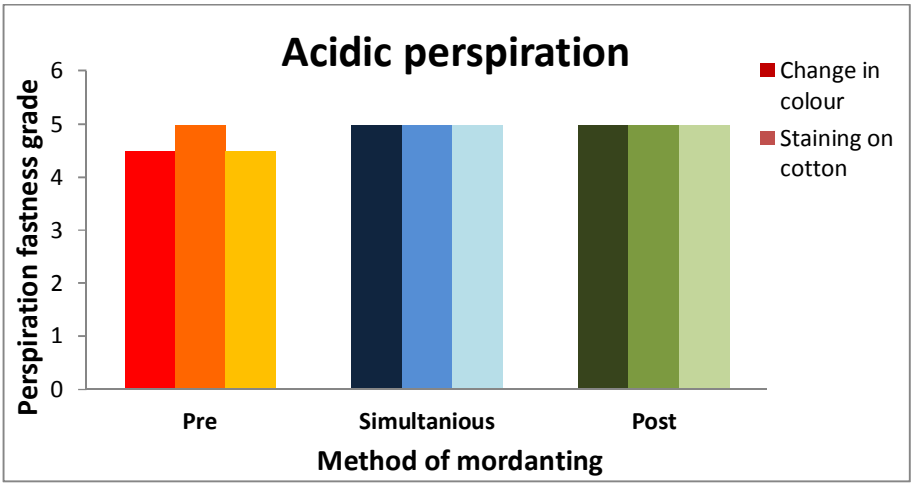
Graph 3



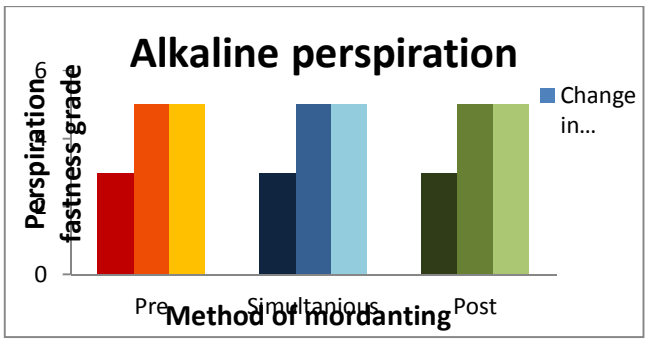
Colour fastness to perspiration:

It was found that post mordanted samples dyed with peel of black cardamom exhibit good perspiration fastness. Table 6 reveals that the alkaline perspiration fastness of all the samples was better than acidic perspiration but samples tend to change colour in alkaline perspiration. In acidic perspiration test, pre mordanted fabric showed slight change in colour (4/5) and staining on silk fabric (4/5)

Graph 4



Graph 5



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Conclusion

It can be concluded from the above results that mordanting done in the acidic medium improves the colour fastness. Some samples showed change in colour in acidic and alkaline perspiration test. Post mordanted fabric results in good colour fastness. Overall, the serviceability of the dyed fabric with black cardamom was found good. Cost of the dye is very low as it is made from byproduct of black cardamom. It is eco-friendly because it is made from natural raw material. So, it may be used for production of dyed textiles on a large scale.

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