

Dyeing of Cotton with Natural Dye Extract from Coconut Husk

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Abstract

A dye is a colored substance that has the ability to color materials such as textiles, paper, ink, foodstuff, cosmetics, medicine and many others. Hence, a natural dye means an extracted colored component from any organic materials such as plants, animals and minerals (Siva, 2007). Natural dyes are considered eco-friendly as these are renewable and biodegradable are skin friendly and may also provide health benefits to the wearer. Natural dyes can be used for dyeing almost all types of natural fibers and provide more elegant, soothing and aesthetic colors to the fabric. A natural dye was extracted from coconut husk powder and used to dye cotton fabric at different dyeing conditions. Cotton fabric was dyed using two different mordants with different mordanting techniques. Eco-friendly mordants were used alum and vinegar. Samples were dyed at temperature 80°C with different concentrations of 4%, 6% and 8% in 100ml of water for 45 minutes. The rubbing, light and washing fastness of dyed samples were testing with gray scale. Result indicate the 6% dye shade with 8% mordant, 4% dye shade with 6% and 8% dye shade with 6% mordant's was best for the cotton fabric and washing fastness and light fastness was satisfactory.

Keywords: Natural dyeing, Coconut husk powder, Mordants, Rubbing fastness, Light fastness and Washing fastness

I. INTRODUCTION

Dyeing is the process of adding color to textile products like fibers, yarns, and fabrics. Dyeing is normally done on the material with a special solution containing dyes and particular chemical. The temperature and time controlling are two key factors in dyeing. There are mainly two classes of dyes i.e. natural and man-made dyes. Dyeing is the most important part of fabric. The chemicals used for dyeing purpose are toxic to environment. The methods got more sophisticated with time and techniques using natural dyes from crushed fruits, berries and other plants, which were boiled into the fabric and gave light and water fastness.

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. Alum, chrome, stannous chloride etc are the commonly used mordants. Cotton textile dyeing was done since the medieval period using cheap natural dyes.

The purpose of study is to explore and test eco-friendly dyeing with suitable mordants as they are non-toxic, non-pollutant, easy to handle in nature. Cotton is an excellent fiber for natural dyeing. Now-a-days mostly cotton is eco-friendly. The idea came after read some of the researches use many natural dye such as bottle brush, saffron, degreased coffee beans etc. but coconut husk is used very infrequently for this purpose.

II. OBJECTIVES

The main objectives of the study are as follows:

- To extract the natural coloring dye from coconut fibers.
- To develop suitable percentage shade of extracted dye.
- To test the effect of mordants used on the substrate.
- To test the cotton fabric used for dyeing for rubbing fastness, washing fastness and light fastness.

III. METHODOLOGY

A. Materials

1) Dyeing Agent

- Coconut fiber was used.

2) Substrate

- The 100% cotton cloth was used as substrate.
- Plain weave: 1/1
- Ends and picks per inch: 60/50

3) Mordants

- The following natural mordants were used: Alum and vinegar

4) Equipments/ Instruments Used

- Weighing balance
- Dye bath
- Motorized Crock meter for rubbing fastness
- Launder-o-meter for washing fastness
- Xenon tester for light fastness

5) Dyeing

A pilot study was carried out with coconut husk to check the feasibility of dyeability of cotton fabric.

The coconut fibers were washed with distilled water to remove dirt. Then add 500ml water and 100gms of coconut fiber to a large pot of water and boil it. By turning off the flame the coconut fibers will be steeped and kept it for 2-3 hours so that the color can be extracted from the coconut fibers.

Dyeing was carried out with 2% and 4% shade and was fixed using alum and white vinegar. The result of dyeing was not satisfactory as it was very light and almost washed away after washing. Hence, the dyeing was done by extraction of coconut husk powder dye. The samples were dyed at temperature 40°, 60°, 80°, 100° with concentration of 2% and 4% shade in 100ml of water for 45 minutes. The samples were taken out, washed and dried. After that, the optimal temperature was taken out from it so that the dyeing process can be carried forward at that optimal temperature. Alum and vinegar mordants were used with 1% and 2% concentration.

The dyeing of cotton was carried in four process-pretreatment, extraction of dyes from coconut fiber, mordanting, dyeing and testing.

6) Preparation of Raw Material

40ml of water was taken in a small tub and boiled. Then add .06gm of NaOH, .04gm of Na₂CO₃ and .02gm of detergent.

7) Extraction of natural coloring matter from coconut fiber

Coconut husk were collected from market. Fibers were washed with distilled water to remove dirt, cut into smaller pieces and dried for 2 days.

8) Dyeing and mordanting of cotton fabric

The samples were dyed in different shades 4%, 6% and 8% with 2%, 4%, 6% and 8% mordants at temperature 80°C in 100ml of water for 45 minutes.

9) Mordanting

The three methods of mordanting i.e. pre, simultaneous and post mordanting will be used to dye cotton fabric with natural coloring matter extracted from coconut fibers.

10) Alum

(Potassium aluminum sulfate) is the most common mordant. It is an alkaline mordant. It does not affect color. It is usually used with cream of tartar (potassium bitartrate), which helps evenness and brightens slightly.

11) Vinegar

Vinegar is an acid mordant. A solution of vinegar and water will set any color that runs if an acid mordant was used.

12) Determination of Color Fastness:

- Motorized crock meter instrument use testing the crocking/rubbing of fabric and AATCC – 8 test method used.
- Launder – o – meter instrument use testing the washing fastness of fabric and AATCC – 61 test method used.
- Xenon tester instrument use testing the light fastness of fabric and ISO – B04 test method used.

IV. RESULTS AND DISCUSSION

A. Extraction of Natural Coloring Dye from Coconut Fibers

Table – 1
Extraction of Natural Coloring Dye from Coconut Fibers
Mordant- Alum (2% shade and 1% mordant)

Mordant- Alum (4% shade and 2% mordant)
Mordant- Vinegar (4% shade and 2% mordant)
Mordant- Vinegar (4% shade and 2% mordant)

The above table reveals that dyeing with coconut fiber with 2% and 4% shade using alum and vinegar as a mordant were not satisfactory. This powdered extract was used as dye on cotton fabric with 4%, 6% and 8% dye shade and mordants used with 2%, 4%, 6% and 8% were concentration.

B. Dyeing and Mordanting

1) Development of suitable percentage shade of extracted dye

Table - 2
Development of suitable percentage shade of extracted dye

Dyes	Alum and Vinegar Mordant		
	Pre-Mordanting	Simultaneous Mordanting	Post Mordanting
4%		2%	
6%		4%	
8%		6%	
		8%	

The samples were dyeing by pre-mordanting, Simultaneous mordanting and post-mordanting with alum and vinegar mordant. The 2% shade of dyeing was negligible after washing. Dyes 4%, 6% and 8% shades with 2%, 4%, 6%, 8% mordants were concentration.

2) Effect of mordants used on the substrate

Table - 3
Effect of mordants used on the substrate

Pre-mordanting with Alum and Vinegar			
Sr. No.	Mordant's	% Dye	% Mordant's
1.	Alum	4%	6%
		6%	8%
		8%	6%
2.	Vinegar	4%	8%
		6%	4%
		8%	6%
Simultaneous mordanting with Alum and Vinegar			
Sr. No.	Mordant's	% Dye	% Mordant's
1.	Alum	4%	6%
		6%	4%
		8%	4%
2.	Vinegar	4%	4%
		6%	6%
		8%	4%
Post mordanting with Alum and Vinegar			
Sr. No.	Mordant's	% Dye	% Mordant's
1.	Alum	4%	4%
		6%	4%
		8%	6%
2.	Vinegar	4%	4%
		6%	6%
		8%	4%

The results revealed that pre-mordanting with alum, the 6% dye shade with 8% mordant and vinegar, the 4% dye shade with 8% mordant were best.

The simultaneous mordanting with alum, the 4% dye shade with 6% mordant and vinegar, the 6% dye with 6% mordant was best.

The post mordanting with alum, the 8% dye shade with 6% mordant and vinegar, the 6% dye shade was best with 6% mordant.

3) Rubbing fastness, washing fastness and light fastness properties of cotton fabric dyed with coconut husk powder

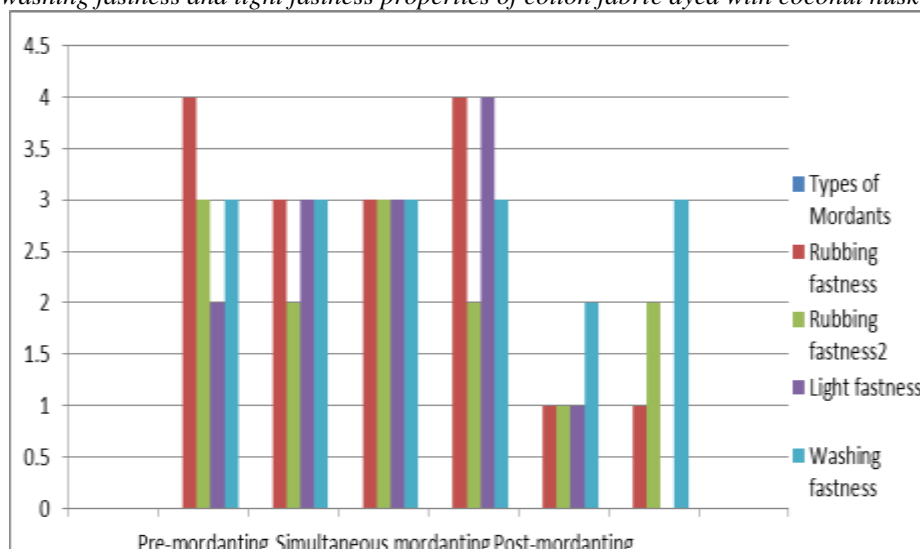


Fig. 1: Fastness ratings of cotton fabrics dyed

The result shows that fastness properties of pre, simultaneous and post-mordanted dyed fabrics were assess. All mordants, the dry and wet crocking fastness was almost satisfactory and washing fastness and light fastness was satisfactory.

V. CONCLUSION

The results fulfilling the required objectives of the study, helped us in conferring that coconut husk which is waste material could be effectively used as a dyeing agent with moderately good results. The optimal condition for dyeing method was found to be at 80°C with a concentration of 4%, 6% and 8% shade of dye at 45 minutes using mordants alum and vinegar. The fastness properties i.e. rubbing fastness, washing fastness, and light fastness of tested dyed fabrics were also found to be satisfactory. Hence, is inferred that coconut fiber lead to good dyeability of cotton fabrics.

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