



ECOFRIENDLY DYE EXTRACTED FROM *JUGLANS REGIA* (WALNUT SHELL) AND APPLICATION ON COTTON FABRIC

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ABSTRACT:

The natural dyes are increasing the awareness among all peoples. Natural dyes are used because of their best nontoxic properties and it is eco-friendly in nature. Some natural dyes have its own medicinal value and it gives more benefits to human as well as environment. This study deals with the natural dye, and it was extracted from the shell of *Juglans Regia* (Walnut). Here, the aqueous extraction method was followed to extract the dye from walnut. The dye from the *Juglans Regia* (Walnut) is giving a beautiful earthen shades and it has excellent dyeability in the cotton fabric. The extracted dye was applied on the cotton fabric with and without mordant. Three types of mordants are used to get a different shade of colours. Thickness, colourfastness and absorbency tests were taken in all the dyed and undyed samples.

Index Terms: Natural dye, walnut, Natural mordants, Colour fastness

I. INTRODUCTION

Natural dyes are free from chemicals and it does not have any harmful effects on the human skin. Natural dyes are less polluting and toxic to the environment, and it promotes the green revolution [1]. Usually, natural dyes are considered to be safe because it has biodegradable, non-allergic and nontoxic properties [2].

Cotton is one kind of shrub it grows in tropical and subtropical regions around the world. The cotton fibers are grown in the seed boll of the cotton plant [3]. It was grown and cultivated in warm places. Each fiber has a single elongated cell that resembled like flat and twisted [4]. Cotton is the non food crop and it has about 90 percent of cellulose and 6 percent of moisture and 4 percent of natural impurities. Cotton has excellent property of elasticity, drapability, heat conductivity and absorbency etc [5].

Juglans Regia (Walnut) is single seeded and circular shaped fruit. The *Juglans Regia* (Walnut) outer shell was considered as waste material. So, these walnut shells are used to extract the dye and dyed the cotton fabric with the help of natural mordants [6]. The word mordant is derived from Latin word means "bite". Many of the natural dyes are easily fades and bleed the colour badly without mordanting. Mordants can applied on the wet fabric in three ways, they are applied before dyeing, during dyeing or sometimes after dyeing [7].

II. MATERIAL AND METHODOLOGY:

2.1 Material:

The 80's count of cotton fabric was used in this study to enhance the affinity of natural dyes. Two meter of cotton fabric and walnut shell was purchased from commercial market.

2.2 Methods:

Desizing of selected fabric:

Desizing is an essential stage for cotton pretreatment. Desizing is the process of removing the "size" material from the cotton fabric, which is necessary before dyeing, printing and finishing. This process helps to absorb dye equally in the fabric.

Table 1: Recipe for Desizing

S.no	Requirement	Amount
1.	Fabric weight	272gm
2.	Detergent	5%
3.	Water(M.L.R)	1:20
4.	Temperature	100°C
5.	Time	1 hour

Extraction of dye from walnut shell:

The walnut shell was soaked in aqueous solution for four hours. Then the 500gms of shells are used for each separate sample and boiling it in 2000ml of water till the extracted solution was reduced to 300 ml. Then this stock solution was filtered and used for dyeing.

Mordanting techniques:

Myrobalan, Pomegranate peels powder and Tea dust was used as a mordant in this study. Myrobalan is used as a pre-mordanting method, pomegranate peel powder and tea dust were used as simultaneous mordanting method.

Dyeing of cotton fabric:**Table 2: Recipe for dyeing**

S.no	Requirement	sample 1	Sample 2	Sample 3
1.	Selected material	68gm	68gm	68gm
2.	Mordant	Myrobalan=25gm	Pomegranate =25 gm	Tea dust =25 gm
3.	Dye solution	300 ml	300 ml	300 ml
4.	Temperature	60 ⁰ C	60 ⁰ C	60 ⁰ C
5.	Time	60 min	60 min	60 min

The three samples are boiled with the 25 gm of mordants and 300 ml of water for 30 mins. Then the fabric was immersed in mordant solution and boiled for 30 mins. The mordanting sample was immersed in 300 ml of dye solution and boiled it for 1 hour to get good affinity of dye. The fabric was taken out from the dye solution and gentle squeeze was given to the sample and dried the sample completely in shade. For sample 1 pre-mordanting technique was used and sample 2 and 3 is done by simultaneous mordanting technique.

2.3 Evaluation

Evaluation is carried out to find the efficacy of the dyed fabric is done according to the standard methods.

Thickness

Thickness gauge was used in this study to determine the thickness of the fabric. Here, the fabric thickness was determined according to the ASTM standards. Place the sample on the anvil plate and the lever of pressure foot is released slowly and pressed slightly on the sample. The dial of the thickness gauge indicates the thickness value.

Colour fastness**Colour fastness through washing**

In the test, change in colour of the dyed sample and also staining of colour on the adjacent white fabric is assessed. A dyed sample was sandwiched between the two adjacent white fabrics and stitched together and washed in water with some soaping treatment. After washing the samples was dried and evaluate the colour change and staining with the help of grey scale.

Colour fastness through crocking

Crock meter was used to determine the colour fastness of the dyed fabric. Here, the crocking was done by using two methods in wet and dry condition. The colour fastness of a dyed fabric is assessed by the transfer of colour from dyed fabric to another piece of undyed fabric. The wet or dyed sample was rubbed in white fabric and then the colour change and staining was evaluated with the help of grey scale.

Absorbency through sinking and wicking

Sinking and wicking test was used to find the absorbency of the fabric. The dyed fabric was cut into a small square piece then put the sample in water containing beaker for sinking. The dyed sample was cut into a strip, then dips the one end of sample in water containing beaker. With the help of stopwatch, the time taken for sinking and wicking is noted and evaluates the absorbency of the dyed fabric.

IV RESULT AND DISCUSSION**4.1 Assessment of thickness of fabric (mm)****Table 3: Fabric thickness (mm)**

S.no	Sample	Fabric weight (mm)
1	Undyed fabric	0.246
2	Dyed fabric (myrobalan)	0.316
3	Dyed fabric (pomegranate)	0.324
4	Dyed fabric (tea dust)	0.306

The above table shows the fabric thickness in mm of before and after dyeing of fabric. There was an increase in thickness of dyed fabric then the undyed one. The fabric dyed with pomegranate mordant has high thickness then the other samples.

4.2 Assessment of colour fastness through washing

Table 4: Colour fastness through washing

S.no	Samples	Colour fastness through washing	
		Before	After
1.	Dyed fabric (myrobalan)	5	4/5
2.	Dyed fabric (pomegranate)	5	4/5
3.	Dyed fabric (tea dust)	5	4

The above table shows the colour fastness rating of before and after washing of dyed fabrics. Compare all the dyed samples, the fabric dyed with myrobalan and pomegranate mordant has very good colour fastness. The rating 5 is excellent colour fastness, 4/5 is very good, 4 is good, 3 is moderate, 2 is poor and 1 is very poor colour fastness is according to the standards.

4.3 Assessment of crocking

Table 4: Colour fastness through crocking

S.no	Samples	Colour fastness through dry crocking		Colour fastness through wet crocking	
		Before	After	Before	After
1.	Dyed fabric (myrobalan)	5	5	5	4/5
2.	Dyed fabric (pomegranate)	5	5	5	4/5
3.	Dyed fabric (tea dust)	5	5	5	4/5

The above table shows the colour fastness rating of dry and wet crocking of dyed fabrics. The dry samples of crocking gave excellent fastness and wet fabric bleeds colour during crocking.

4.4 Assessment of absorbency (Sinking and Wicking)

Table 5: Absorbency test

S.no	Sample	Sinking	Wicking
		Time taken for sinking	Rising level of water
1	Undyed fabric	180 sec	0.3cm
2	Dyed fabric (myrobalan)	18 sec	4.5cm
3	Dyed fabric (pomegranate)	6 sec	4.4cm
4	Dyed fabric (tea dust)	13 sec	2.7cm

The above table shows the absorbency of dyed and undyed samples. In sinking, all the dyed samples are immersed within a minute and it has good sinking property. In wicking, all the dyed fabrics have good wicking property because all dyed samples are raising the water level in the test sample.

V CONCLUSION:

Reviewing the result of this study "Preparation and Application of walnut shell dye on cotton fabric". Developed three different shades of natural dyes by using various mordants it gave beautiful earth shades, they were evaluated among that sample-1,2,3 was rated as very good. Walnut dyes gave lighter shade and it was biodegradable. So I have dyed this walnut dye on cotton fabric to promote the natural dye.

Reference:

- [1] Agarwal A, Goel A & Gupta K C, (1992), Textile Dyers and Printer.
- [2] Vankar P S and Shanker R, (2009) "Eco-friendly pretreatment of silk fabric for dyeing with Delonix regia extract," Coloration Technology, vol. 125.
- [3] Candace H. Haigler, Lissete Betancur, Michael R. Stiff, John R. Tuttle, (2012), Cotton fiber: a powerful single-cell model for cell wall & cellulose research.
- [4] Bernard P. Corban, (1983), Fiber to Fabric, Library of congress cataloging in publication data
- [5] Marry Dugan, (2009), Commodity of the quarter cotton, Journal of agriculture and food information fiber, IOSR- Journal of polymer and textile engineering.
- [6] Hemalatha Jain, (2010), Techniques of dyeing and printing, Ave books private limited.
- [7] Alka Ali and Anita Nishkam, (2016), Extraction Of dye from walnut shell and dyeing of natural fiber, IOSR Journal of polymer and textile engineering.
- [8] Amajeet Daberao, Ranjit Turukmane, Prafullprabhakar Kolte, (2016), Cotton dyeing with natural dye.
- [9] Gulrajani M.L., Gupta, D., (1992), "Natural Dyes and Their Application to Textiles", Department of Textile Technology, IIT, New Delhi.
- [10] Prabhu. K.H, Aniket S. Bhute, (2012), Plant based natural dyes and mordants, Scholar's research library.