

ECO-FRIENDLY DYEING OF BANANA FABRIC USING ORGANIC DYES**Sowmmiya S¹, Harini K², Priyanka S³**¹Assistant Professor, Department of Fashion Technology, Bannari Amman Institute of Technology,
Sathyamangalam^{2,3}UG Scholar, Department of Fashion Technology, Bannari Amman Institute of Technology,
Sathyamangalam**ABSTRACT**

Nowadays our lifestyle is changing suddenly, people are running back to the natural and organic products. And everyone wants the environment to be eco-friendly. And the textile industry is also getting more ecofriendly. They are preferring natural dyes than manmade dyes. This paper is about the importance of natural dyes in textile application and about the antibacterial properties in the natural dyes. In this paper the natural dyes such as henna, turmeric and indigo were used. Among these dyes turmeric shows the best color and also it shows good antibacterial properties. Firstly, the banana fabric was scoured and two types of mordants were used i.e., copper sulphate and alum. Secondly the banana fabric was dyed with turmeric, henna and indigo. Then the fastness properties were taken for dyed fabrics. And then finally antibacterial test was taken for the dyed fabrics.

Keywords:

Natural dyes, banana fabric, turmeric, fastness, antibacterial.

INTRODUCTION

Dyeing plays a major role in textile industry. There is more type of dyes such as synthetic dyes, natural dyes, direct dyes, disperse dyes, reactive dyes etc., Today natural dyes have become more popular in textile industry. The dye which is extracted from the plants, flowers, fruits are known as natural dyes, which is used to give color to the textiles, foods and even in cosmetics. By using synthetic dyes, it causes environmental pollution. To avoid that researcher are finding new ways to give hygienic and good quality products to customers and i.e., natural dyes. Natural dyes are eco-friendly and biodegradable. These natural dyes are used in dyeing of linen, polyester, cotton, wool, silk etc., Some natural dyes like turmeric, henna, indigo gives antibacterial, antimicrobial and antioxidant property also. Banana fabric- Banana tree has many uses such as fruits as food, leaves are used for wrapping the foods and banana stem is used for producing the fiber and then the paper pulp. Banana is forming the family Musaceae and it is grown in nearly 130 countries in the world. India is the largest producer of banana followed by China, Indonesia, Brazil etc., Banana fabric is made from sheaths of the banana stem and then processing the fibers into yarn. The banana fabric is made from hundred percentage of banana stem. The banana fabric undergoes certain process i.e. peeling of the bark into strips which will be thin and then it will be boiled in alkaline solution that makes into soften, dissolve the bark and then wet spinning and finally weaving the fabric. These banana fabrics are cool fabrics, and it is sweat absorbent and breathable. The banana fabric will be silky and non-irritating. It will be soft and safe to use. These manufacturing of banana fabric will be eco-friendly.

Natural dyes- Turmeric- The scientific name of turmeric is *Curcuma longa* from the family Zingiberaceae. Turmeric is commonly used in foods, it helps in improving the immune function and also it helps in curing many diseases, wounds etc., It is antibacterial, antioxidant and anti-inflammatory. It is rich in phenolic compounds which is called as curcuminoids. The turmeric is used in preparing the dye solution which is used for dyeing, and it is more common and popular in natural dyes which is used in textile industry. And India is the first largest producer of turmeric around the world. It is also eco -friendly and turmeric gives good bright shades. In this research turmeric is used as dye solution which will be applied in banana fabric by following certain dyeing conditions.

Natural dyes- Henna –Indigo, Henna is commonly used for dyeing in hair colors, cosmetics. Henna is a natural dye which can used in dyeing of textiles. Henna has both antimicrobial and antifungal properties. But for good and long lasting colors mordanting isrequired which gives good results. Indigo – indigo gives unique and different shade of blue color. This indigofera tinctoria shrub grows in the tropical regions. These dyes are extracted from the leaves

of the indigo plant which gives eye catchy blue color. Among the samples of turmeric, henna and indigo, turmeric shows the best result i.e., good color with antibacterial property.

MATERIALS AND METHODS

Raw material

Turmeric (*Curcuma Longa*), Indigo (*Indigofera tinctoria*) and Henna (*Lawsonia inermis*) was used as a raw material for the preparation of dye solution for dyeing. The ready for dyeing banana fabric was taken. Turmeric was used to obtain yellow color, indigo was used to obtain blue color and henna was used to obtain brown color. The mordants such as potash alum and copper sulphate was used.

Methods:

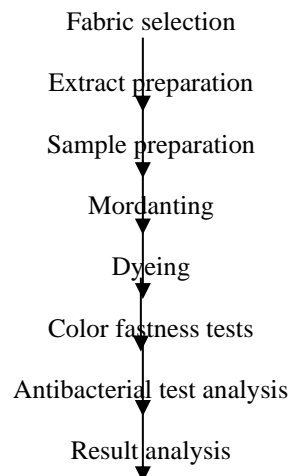
Turmeric was crushed into powder form. Two samples were taken. And these samples were pre-mordanted with potash alum and copper sulphate separately. The mordants were freshly prepared by dissolving 5% in distilled water at ratio of 1:20. Now the sample gives rich yellow color. The fabric were squeezed and air dried in premordanting process.

Indigo leaves was crushed into powder form. Two samples were taken. And these samples was premordanted with potash alum and copper sulphate separately. The mordants were freshly prepared by dissolving 5% in distilled water at ratio of 1:20. Now the sample gives blue color. The fabric were squeezed and air dried in premordanting process.

Henna leaves was crushed into powder form. Two samples were taken. And these samples was premordanted with potash alum and copper sulphate separately. The mordants were freshly prepared by dissolving 5% in distilled water at ratio of 1:20. Now the sample gives rich brown color. The fabric were squeezed and air dried in premordanting process.

Fig.1: Premordanting in dyebath



Fig.2:Dyed samples of turmeric , indigo and henna with alum and copper sulphate**METHODOLOGY****SCOURING PROCESS**

The scouring was done in power loom banana fabric in a bath containing 3% of sodium carbonate and soda of 2% and surface active agent of 1% which is used to purify the banana fabric. This banana fabric will be immersed in the bath at 60 degree C for 30 minutes according to the liquor ratio of 1:20. And then the scoured banana fabric was dipped in normal water and it will be dried under shadow. After this the scoured banana fabric was dipped in pure water for 30 minutes before going for mordanting.

PREMORDANTING WITH ALUM

The alum (potash aluminum sulfate) is the mordant used here. This alum helps the natural dyes to penetrate easily into the fabric. This alum is the commonly used mordant in dyeing of the fabrics. This mordant makes the natural dyes to stick onto the fabric and makes the color to be bright and it will be safer to use.

This pre-mordanting was done with material : liquor ratio , M:L = 1:10. The temperature used was 70°C for 60 minutes along with the concentration of 10%. After this pre-mordanting the sample fabric will be taken out for dyeing. The fabric shouldn't be washed after this pre-mordanting. This samples will be dried under the shadow.

PREMORDANTING WITH COPPER SULPHATE

The copper sulphate is used as mordant here. This copper sulphate helps the dye to penetrate more into the fabric. It makes the fabric soft and makes the color brighter.

This pre-mordanting was done with material : liquor ratio , M:L = 1:10. The temperature used was 70°C for 60 minutes along with the concentration of 10%. After this pre-mordanting the sample fabric will be taken out for dyeing. The fabric shouldn't be washed after this pre-mordanting. This samples will be dried under the shadow.

DYEING PROCEDURE

Three extracts turmeric, henna and indigo were used for dyeing. The materials required are taken according to the M:L ratio (i.e 1:20) The temperature is set to 60°C. Then the 50% of salt is added to the dyebath. Then the pre-mordanted samples are introduced to the dyebath and the temperature is increased to 90°C. The samples are then dyed for a period of 60mins. Then the samples are taken out and the cold wash was carried for the samples. Then the antibacterial test was carried out for those dyed samples.

COLOUR FASTNESS PROPERTIES

Three types of fastness properties were tested here i.e. light fastness, wash fastness and rubbing fastness.

Light fastness:

The light fastness is a type that comes under color fastness, which is used to identify how much it's fading when kept under sunlight or artificial light. This test is done by light fastness tester. The sample which is dyed with henna, turmeric and indigo is made into 20*15 cm in the holder and the sample is kept under the xenon light for a time period of 24 hours. After this the fabric sample was removed from the holder and then it will be assessed by the computer color matching system.

Table.1: Grades based on the light fastness property

Grades	Range	Stages of fading
1	Very poor	Very much fading
2	Poor	Much fading
3	Moderate	Negligible fading
4	Good	Low fading
5	Better	Very low fading
6	Excellent	No fading

Wash fastness:

This wash fastness is a type that comes under color fastness, which is used to identify how much it's fading by washing or by dry cleaning. This washing fastness is done by laundrometer. The sample which is dyed with turmeric, indigo and henna are made into 15*6 cm in the ratio of 60:1. And then two pieces of 10*6 pure white fabric will be taken. Then the pure white samples were kept on the dyed sample with half part was exposed to sample and another half part will not be exposed. And then the samples are kept into the container with some solvents. For soaping treatment the samples were taken to the laundrometer. After that the samples are taken from the chamber. And then the samples are kept dried with 40°C. And then the samples were compared and analyzed by using the grey scale value.

Table.2 :Grades based on wash fastness property:

Grades	Range
1	Poor
2	Moderate
3	Better
4	Best

Rubbing fastness:

Rubbing fastness is a type that comes under color fastness, which is used to identify how much the fabric will resist stains. This can be done in both dry and wet condition. The samples which are dyed with turmeric ,indigo and henna are made into size of 14*6 cm and the white samples of the size 6*6 cm. This rubbing fastness test is done by using crock meter.

In dry condition the fabric dyed samples were rubbed against the pure white samples. Nearly 9 to 10 rounds were given to samples. After this the sample which is rubbed is compared with the grade to find the range of staining.

In wet condition the fabric dyed samples were rubbed against the pure white samples. Nearly 9 to 10 rounds were given to samples. After this the sample which is rubbed is compared with the grade to find the range of staining.

Table.3 : Grades based on rubbing fastness property:

Grades	Range of fastness
1	Poor
2	Moderate
3	Good
4	Extraordinary

ASSESSMENT OF ANTIBACTERIAL ACTIVITY

Qualitative method AATCC 147 and quantitative method AATCC 100 were used to determine the antibacterial activity of the dyed and undyed fabric.

Qualitative analysis:

Antibacterial activity of the sample was tested by AATCC 147- 2016 – Parallel streak method. The normal width of a zone of inhibition was determined.

Quantitative analysis:

Antibacterial activity of the sample was tested by AATCC 100 for quantitative assessment of the antibacterial efficiency against staphylococcus aureus bacteria and Klebsiella pneumonia. The reduction of bacterial count was calculated by,

$$R_b(\%) = (Y-X)/Y \times 100$$

R_b - The percentage reduction of bacteria count.

X - The sum of bacteria's recovered from inoculated test

Y - The sum of bacteria's of the undyed fabric.

RESULTS AND DISCUSSION

Alum and copper sulphate are two different mordants which is pre-mordanted. Among these two the alum helps the dyes to penetrate more on the fabric and it makes the color even brighter. Turmeric with alum shows the best fastness. The concentration was 10%. In wash fastness the turmeric with alum shows the grade 3 which is better. And for the light fastness with the concentration of 10% the turmeric shows the grade 4 which low fading. And for rubbing fastness in dry condition the turmeric with alum shows 4-5 which is excellent. And also in wet condition it shows 4 which is good. Based on the comparison of henna, turmeric and indigo, the henna and turmeric show good light, wash and rubbing fastness. And turmeric is even more far better than henna with the concentration of 10% of copper sulphate and alum.

Table.4 : Fastness properties of dyed samples

S. No	Mordant	Extracts	Wash fastness	Light fastness	Dry rubbing	Wet rubbing
1	Alum	Turmeric	3	4	3-4	3
		Henna	3	4	3	3
		Indigo	2	3	2	2
2	Copper sulphate	Turmeric	3	4	3-4	3
		Henna	2	4	3	2
		Indigo	2	4	2	2

Antibacterial test was taken for henna , turmeric and also for indigo with two bacteria's such as staphylococcus aureus and klebsiella pneumonia. In qualitative method the antibacterial test was made. With alum , the turmeric shows the best inhibition i.e. 12mm in S.Aureus and 9mm in K.Pneumonia. With copper sulphate , the turmeric shows the best inhibition .i.e. 11mm in S.Aureus and 8 mm in K.Pneumonia.

In quantitative method the antibacterial test was made. With alum the turmeric shows the best inhibition i.e. 98.67% in S.Aureus and 99.31% in K.Pneumonia. With copper sulphate the turmeric shows the best result i.e. 97.93% in S.Aureus and 99.12% in K.Pneumonia.

Table.5: Antibacterial activity by using qualitative method

S. No	Particulars	Extracts	Zone of inhibition in mm	
			Staphylococcus aureus	Klebsiella pneumonia
1	Untreated fabric	-	0	0
2	Premordanted with Alum	Turmeric	12mm	9mm
		Henna	10mm	7mm
		Indigo	9mm	6mm
3	Premordanted with Copper sulphate	Turmeric	11mm	8mm
		Henna	10mm	6mm
		Indigo	8mm	6mm

Table -6: Antibacterial activity by using quantitative method

S. No	Particulars	Extracts	Bacterial reduction percentage	
			Staphylococcus aureus	Klebsiella pneumonia
1	Untreated fabric	-	0	0
2	Premordanted with Alum	Turmeric	98.67%	99.31%
		Henna	96.71%	97.64%
		Indigo	95.63%	96.86%
3	Premordanted with Copper sulphate	Turmeric	97.93%	99.12%
		Henna	96.89%	98.75%
		Indigo	95.88%	94.62%

CONCLUSION

Nowadays natural dyes are becoming more popular and people are preferring natural dyes than synthetic dyes. In this paper the natural dyes such as henna, indigo and turmeric were dyes as samples. Among that turmeric shows best color and also it provides antibacterial activity. This research paper concludes that turmeric shows best result compared to henna and indigo. The fabric used here is banana fabric. The banana fabric has good absorbency compared to other fabrics and it is eco-friendly, harmless. It will be safe to use. The banana fiber is used in many ways such as currency notes, tea bags etc. In this paper the natural dyes such as turmeric, indigo and henna was dyed and pre-mordanted with two different mordants such as copper sulphate and alum. Among this alum with turmeric dyes shows the best color and then the antibacterial test was taken. And the fastness properties such as wash fastness, rubbing fastness and light fastness were done. In light fastness the turmeric and henna shows the best result i.e. grade 4 and in wash fastness the turmeric shows the best result i.e. grade 3. In dry rubbing fastness the turmeric shows the best result i.e. grade 3-4 and in wet rubbing the turmeric shows the best result i.e. 3. In qualitative method, the turmeric which is pre-mordanted with alum inhibits much bacteria i.e. 12mm for s.aureus and 9 mm for klebsiella pneumonia. In quantitative method, the turmeric which is pre-mordanted with alum shows the best result i.e. 98.67% for s.aureus and 99.31% for klebsiella pneumonia. It concludes that alum with turmeric shows the best color and fastness properties were taken and finally antibacterial test was done.

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