IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 3, March 2025

DOI: 10.17148/IARJSET.2025.12325

DEVELOP A RANGE OF HUES & SHADES USING *COCOS NUCIFERA & LAWSONIA INERMIS*

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Abstract: Natural dyes from renewable sources such as Plants, Fruits, and Minerals have gained popularity as environmentally friendly alternatives to synthetic dyes. This study focuses on the extraction and application of natural dyes derived from coconut husk and henna, using eco-friendly mordants such as vinegar (acetic acid) and lemon juice (citric acid) to dye Kid -garments. With an increasing awareness of the environmental and health risks connected with synthetic dyes, this study emphasizes the necessity of natural dyeing methods in the textile sector, particularly for sensitive applications such as children's clothes. Coconut husk, a readily available agricultural byproduct, contains tannins and polyphenolic chemicals that give fabrics a warm brown tone. Henna, best known for its natural reddish orange pigment (lawsone), is also renowned for its colouring properties. Pigments from these sources are aqueously extracted and then applied to pre-treated cotton fabric. Vinegar (acetic acid) and lemon juice (citric acid) are used as mordants to absorb and fix dyes. Temperature, pH, and mordanting were all parameters considered while dyeing to promote colour fastness and vibrancy. The dyed samples are tested to determine whether they are suitable for practical use. The tests includes perspiration resistance, colour fastness to light, rubbing, and Washing. These tests ensure that the dyed cloth can endure wear and tear, making it suitable for kids' garments.

The findings revealed that both dyes had a high affinity for natural textiles like cotton, and that applying mordants like vinegar (acetic acid) and lemon (citric acid) improved colour retention. The colouring procedure has no negative impact on the environment, resulting in composting biodegradable residues. This study not only highlights the potential of natural resources and also emphasizes the role of eco-friendly products in sustainable textile products. By combining traditional dye with modern techniques, the natural dyes can provide a viable and environmental consciousness.

Keywords: Cocos nucifera, Lawsonia inermis, Cotton, Acetic acid, Citric acid, biodegradable

INTRODUCTION

The textile processing industry is one of the biggest environmental polluters, because effluent from these industries involve a lot of chemicals including dyes used in the textile processing. There are two main techniques to decrease the environmental influence of textile manufacturing. They are either via developing really large and effective effluent treatment plants or use of eco-friendly dyes & chemicals.

There is currently a high demand for the application of organic colours all over the globe, which is due to the cancers-causing and non-degradable character linked with artificial dyes. They do not create any unwanted by-products, and moreover these types of colours assist in restoring the environment, thus natural pigments are known as safer dyes.

Over time, the structure of organic compounds has changed, and their use in synthetic dyes has changed as well. These changes have had a variety of negative impacts on the environment and human health. A person who uses synthetic dyes is susceptible to a wide range of health problems, including hypersensitivity and dermatitis, as well as behavioural disorders like hyperactivity. Children are also susceptible to these harmful consequences. More broadly, synthetic dyes disrupt intricate ecosystems by polluting the land and water. Particularly detrimental effects of synthetic dyes are seen in aquatic biological systems. Instead of storing carbon dioxide, many reservoirs now freely release it along with other greenhouse gasses. Even more severe climate change is the outcome.

The German government was the first to take action, enacting the German Legislation (Consumer Goods Ordinance) on January 1, 1995, which prohibited the production, dyeing, and importation of textiles and other consumer goods dyed with azo dyes. The Netherlands followed suit with a ban that went into force on August 1, 1996. These harmful dyes are probably going to be banned by the European Union soon.

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DOI: 10.17148/IARJSET.2025.12325

Additionally, the use of certain azo-dyes has been prohibited in India, and under the notification, "sufficient legal teeth" have been granted for pursuing panel action against individuals who use these dyes.

Since ancient times, natural dyes have been used to colour fabrics and other materials. They are a sustainable alternative to synthetic dyes. Because they can create a range of colours that are frequently thought of as waste, henna and coconut husk make great natural dyes.

The coconut husk has 70% pith and 30% fiber. Additionally, it has a high phenolic content, cellulose (41%), and lignin (40%). Coconut fiber's high lignin content adds to its elasticity and toughness. Additionally, it prevents the coconut fiber from decomposing. Additionally, potassium and tannin are found in coconut husk. About 30–35% of the entire coconut is made up of the endocarp, mesocarp, and exocarp, which make up the coconut husk. An estimated 5280 kg of dry coconut husk are produced annually per hectare, which is a substantial amount, therefore waste management is desperately needed. Using the coconut husk as a natural colour is one way to give the trash some value. Thus, the use of coconut waste as a natural dye can be inexpensive, non-toxic, effective, and easily accessible. As a result, using coconut waste as a natural colour can save waste management expenses and lessen pollution in the environment.

A shrub in the Lythraceae family, Lawsonia inermis Linn is also referred to as henna. Henna's staining ability is mostly ascribed to lawsone, a naphthoquinone molecule that is abundant in the dried leaves. Hennotannic acid gets its name from the chemicals in these dried leaves that give them a brown hue because they share chemical characteristics with tannic acid.

Fixing the colour onto cloth is one of the most difficult problems that needs to be solved before natural dyes can be widely used in the textile industry. In order to solve this issue, the kind of mordant and the mordanting technique are crucial. Thus, the goal of this study is to optimize the process of extracting natural dye from coconut husk and henna and applying it to kid garment using different kinds of mordants and mordanting techniques.

OBJECTIVES

- To achieve a vibrant and long -lasting colours using cocos nucifera and lawsonia inermis as a natural dye source for a kid garment.
- To develop the natural dye in a reasonable price.
- To reduce the environmental impact caused by synthetic dyes.
- To promote the natural dyes.
- To evaluate the influence of natural mordants, such as vinegar (acetic acid) and lemon juice (citric acid), on dye uptake and colour fastness.

METHODOLOGY

SELECTION OF RAW MATERIALS

FABRIC: COTTON

NATURAL RESOURCES: COCONUT HUSK , HENNA

MORDANT: ACETIC ACID (VINEGAR),CITRIC ACID(LEMON)

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PRE – PREPARATION

(Fabric Preparation, Drying & Cleaning the dye materials)

EXTRACTION OF DYE

(Double boiling method)

STRAIN & FILTER

(Separate dye liquid from solid)

DYEING

(Tie & Dye Method in Diamond pattern technique)

PATTERN MAKING & STITCHING

EMBROIDERY

TESTING & EVALUATION

RESULT

3.1 SELECTION OF RAW MATERIALS:

3.1.1 FABRIC:

Cotton fabric is soft, breathable, and absorbent. It is a wonderful fabric for children's clothing. Cotton fabric is non-toxic, hypoallergenic, and smoothing on the skin. It's also long-lasting and easy to maintain. Cotton fabric is appropriate for manufacturing a wide range of children's clothes such as t-shirts, dresses, and slacks.

Fig 1: Cotton Fabric

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NATURAL RESOURCES:

COCONUT HUSK:

Coconut husk includes a high concentration of lignin, a complex chemical component that gives the dye its dark colour. It is a sustainable and environmentally beneficial natural dye. Coconut husk colouring is nontoxic biodegradable, and pleasant on the skin. It generates a variety of colours, from light brown to dark brown.

Plate 1: Coconut husk

HENNA:

Henna contains lawsone, a pigment that binds to keratin in hair and fibers, resulting in a reddish-brown tint. Henna is a natural conditioner that is good for the skin and hair. Henna dye is nontoxic, hypoallergenic, and mild on the skin. It creates a variety of colours, including orange and reddish brown.

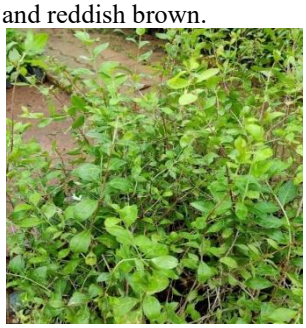

Plate 2: Henna Plant

MORDANT:

CITRIC ACID:

Plate 3: Citric acid (Lemon)

A natural mordant that aids in the dye's adhesion to the fabric is citric acid. It is a moderate, biodegradable, and non-toxic acid. A deeper, more uniform colour is produced by the use of citric acid. Additionally, it prolongs the life of the clothing by acting as a natural preservative.

ACETIC ACID:

A natural mordant that aids in the dye's adhesion to the fabric is acetic acid. It is a moderate, biodegradable, and non-toxic acid. Acetic acid helps create a more uniform, darker colour. Additionally, it prolongs the life of the clothing by acting as a natural preservative

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Plate 4 : Acetic acid (Vinegar)

PRE PREPARATION:

FABRIC PREPARATION:

- Rinse the cotton cloth with warm water to eliminate any dirt or contaminants.
- Combine 1-2 tablespoons of soap nuts with 1 liter of water. Allow it to steep for 30 minutes to an hour.
- Soak the cotton cloth in the soap nut solution for two to three hours.
- Rinse the fabric well with water, then wash it with a light detergent.

REMOVE IMPURITIES FROM NATURAL RESOURCES

- Eliminate impurities from natural resources by sorting the henna and coconut husks to get rid of any contaminants, dirt, or debris.
- To get rid of any remaining contaminants, wash the henna and coconut husks in warm water.
- Rinse the henna and coconut husks thoroughly with cool water.
- Let the henna and coconut husks air dry naturally.
- The dried coconut husks and henna should be finely mixed together using a mortar and pestle or a grinder.

EXTRACTION OF DYE

Weight of the fabric = 95g

Material : liquor ratio = Fabric weight * 30

= 95 * 30

= 2,850 ml

Amount of dyestuff required = fabric weight * 10%

= 95 * 10/100

= 9.5g

Amount of mordant = Fabric weight *3%

= 95 * 3/10

=2.85g

Plate 5: Extraction of dye

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- The Calculated amount of natural dyestuff is made into paste with calculated amount of salt.
- The Paste is mixed with required amount of amount according to the material (Liquor ratio).
- Then the solution is allowed in the water bath for 10mins at 100C.
- Later the sample fabric is wetted and immersed in the dye solution.
- Dyeing is done at 100C for 1hour finally the material is taken out and given a cold wash.

STRAIN & FILTER

Plate 6: Filtered Dye liquid

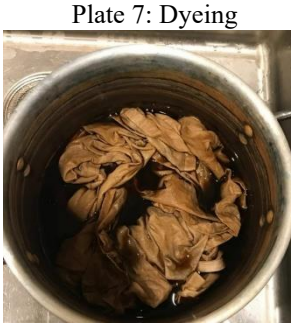
- Place a cheesecloth or cotton cloth over the sieve or colander.
- Carefully transfer the dye mixture from the pot to the sieve or colander.
- Drain the dye liquid into the bowl or container using a cheesecloth or cotton cloth. Discard the solids.
- Use a spoon or spatula to push the solids on the cheesecloth or cotton cloth, extracting as much dye liquid as possible.
- If needed, filter the dye liquid again with a clean cheesecloth or cotton cloth to eliminate any leftover contaminants.
- Transfer the filtered dye liquid to a clean container, discarding any particles or contaminants.

DYEING:

Fold the cloth into a sequence of strips, folding each strip in the opposite direction of the preceding one.

- Bind the folded fabric with thread or yarn to keep it in place.
- Dye the bound cloth with the double boiling process.
- Remove the bindings to show the distinctive patterns produced by the resist dyeing technique.

Plate 7: Dyeing



PATTERN MAKING & STITCHING:

Pattern making is the process of making a template or guide to cut out fabric for garment construction or textile design. Stitching is the process of attaching two or more pieces of fabric together with thread or yarn.

3.7 EMBROIDERY:

The art or craft of using a needle and thread to decorate fabric or other materials is called embroidery. It entails utilizing a variety of stitches and techniques to create patterns, images, or designs on cloth.

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A basic embroidery stitch, chain stitch is frequently used in hand embroidery, machine embroidery, and cross-stitch, among other embroidery stitch.

PROCEDURE FOR CHAIN STITCH:

- At the beginning, insert the needle through the fabric.
- Make sure the needle is pointing in the same direction as the stitch and re-insert it into the fabric about 1/4 inch away.
- Leave a tiny loop on the wrong side of the fabric after bringing the needle back up through it.
- Make sure the needle goes through the loop and re-insert it into the fabric at the same spot as it emerged.
- Tighten the loop by pulling the needle all the way through.
- Repeat steps 2–5 while following the curve or line

TESTING & EVALUATION:

- Colourfastness to Perspiration
- Colourfastness to Washing
- Colourfastness to Sunlight
- Colourfastness to Rubbing
- PH testing

RESULTS & DISCUSSION

COLOUR FASTNESS TO PERSPIRATION

The ISO 971 Perspiration test is a regulated method for determining a textile's colour fastness to perspiration. Here is a step-by-step guide on taking the perspiration test:

PROCEDURE

PREPARING THE TEST SPECIMEN

- **Cutting the Test Specimen:** From the textile material to be tested, cut a test specimen measuring 10 cm × 10 cm.
- **Marking the Test Specimen:** Using a water-soluble marker, designate the different locations for testing.

PREPARING THE PERSPIRATION SOLUTION

- **Prepare the Perspiration Solution:** Prepare a sweating solution in accordance with ISO 971 specifications. The answer is composed of:
  - 1 g/l sodium chloride (NaCl),
  - 1 g/l urea (CO(NH2)2),
  - and 1 g/l lactic acid (C3H6O3).
  - Adjust pH to 5.5 using sodium hydroxide (NaOH) or hydrochloric acid (HCl).

- **Filter the Perspiration Solution**: Use a 0.2 µm membrane filter to eliminate contaminants.

APPLICATION OF PERSPIRATION SOLUTION

- **Application of the Perspiration Solution:** Using a pipette, apply 1 ml of the perspiration solution to the test specimen's indicated region.
- **Spreading the Perspiration Solution:** Using a glass rod or other spreading device, evenly distribute the perspiration solution over the designated area.

INCUBATION OF THE TEST SPECIMEN.

- Place the test specimen in a sealed container or desiccator and incubate for 4 hours at 37°C ± 2°C.
- Humidity Control: Keep the relative humidity at 65% ± 5% during incubation.

EVALUATION OF TEST SPECIMENS

- **Visual Evaluation:** Examine the test specimen visually for colour changes or stains.
- **Colour Measurement:** Use a colorimeter or spectrophotometer to determine the colour of the test material.
- **Staining Evaluation:** Use a staining scale to assess the test specimen's staining.

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RESULT

S.NO	NAME OF THE PRODUCT	DYE EXTRACTS FROM	CLOTH COLOUR	CLOTH SPECIMEN	RESULT
1	TEXTILE	COCONUT HUSK	BROWN	10*40 cm	4
2	TEXTILE	HENNA	YELLOW-ORANGE	10*40 cm	5

COLOUR FASTNESS TO WASHING:

The IS 687 standard provides how to test the colour fastness of textiles after washing. It involves the testing of textiles for colour change or bleeding after washing.

TESTING CONDITIONS:

- Washing by hand or machine
- Detergent solution (5 g/liter)
- Water temperature is 40°C.
- Washing time: 45 minutes - Rinse and dry

ASSESSMENT:

- Colour change
- Staining scale (1–5)
- Grading: 1–5 (5 being the best).

RESULT:

S.NO	NAME OF THE PRODUCT	DYE EXTRACTS FROM	CLOTH COLOUR	CLOTH SPECIMEN	STAINING	RESULT
1	TLTEXTILE	COCONUT HUSK	BROWN	10*40 cm	1	Very Poor
2	TEXTILE	HENNA	YELLOW-ORANGE	10*40 cm	1	Very Poor

The washing test findings revealed that both coconut husk and henna had a colour fastness grade of one, suggesting considerable colour change or bleeding.

COLOUR FASTNESS TO SUNLIGHT:

The textile samples' colour fastness to sunlight was assessed using the IS 2454:1984 test technique. The test method involves exposing textile samples to artificial sunshine (a xenon arc lamp) and measuring the colour change

5.3.1 TEST CONDITIONS INCLUDE:

- Exposure to artificial sunshine (xenon arc lamp),
- Temperature of 25°C ± 2°C,
- Humidity of 65% ± 5%.
- Exposure time: forty hours.

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The staining level for both dyes decreased as the days of sunlight exposure increased, indicating a loss of colour intensity.

COLOUR FASTNESS TO RUBBING:

The textile samples colourfastness to rubbing was determined using the IS 766:1980 test technique. The test procedure is rubbing the textile samples against a white cotton cloth and assessing colour transfer.
TESTING CONDITIONS:

- Rub action: 10 double rubs.
- Rubbing pressure: 9 N
- Material: White cotton cloth.

RESULT:

S.NO	NAME OF THE PRODUCT	DYE EXTRACTS FROM	CLOTH COLOUR	CLOTH SPECIMEN	STAINING	RESULT
1	TEXTILE	COCONUT HUSK	BROWN	10*40 cm	DRY : 1	Very Poor
					WET : 5	Excellent
2	TEXTILE	HENNA	YELLOW-ORANGE	10*40 cm	DRY : 1	Very Poor
					WET : 5	Excellent

➢.NO	NAME OF THE PRODUCT	DYE EXTRACTS FROM	COLOUR FASTNESS TO SUNLIGHT							
			DAYS	1	2	3	4	5	6	7
1	TEXTILE	COCONUT HUSK	STAINING	4	3	2	2	1/2	1	1
			RESULT	Good	Moderate	Poor	Poor	Slightly Poor	Very Poor	Very Poor
2	TEXTILE	HENNA	STAINING	3/4	3/4	3	2	2	1/2	1
			RESULT	Slightly Poor	Slightly Poor	Moderate	Poor	Poor	Slightly Poor	Very Poor

Both coconut husk and henna-dyed textiles demonstrate “very poor” colour fastness to rubbing under dry conditions, with a staining level of 1.
Both dyes showed “excellent” colour fastness to rubbing in wet conditions, with a staining level of 5.

The results indicate that the colour fastness to rubbing significantly improves for both dyes when the textile is wet.

PH TESTING:

The pH of the textile samples aqueous extracts was evaluated using the IS 1396:2012 test technique. The test procedure consists of extracting the textile sample with distilled water and measuring the pH of the extract

TESTING CONDITIONS:

- Medium: Distilled water
- Temperature: 20-30°C
- Duration: 1 hour
- pH: Measured with a pH meter

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RESULT

S.NO	NAME OF THE PRODUCT	DYE EXTRACTS FROM	CLOTH COLOUR	CLOTH SPECIMEN	PH VALUE
1	TEXTILE	COCONUT HUSK	BROWN	10*40 cm	7
2	TEXTILE	HENNA	YELLOW-ORANGE	10*40 cm	5

The findings indicate that coconut husk extract has no substantial effect on the PH of the cloth, which remains neutral. Henna extract, on the other hand, introduces a slight acidity to the textile."

COST OF THE PRODUCT:

Cotton Fabric = Rs 100 per meter

Natural dye = Rs 50

Mordant = Rs 50

Labour cost =Rs 250 (Dyeing & Stitching)

Other costs =Rs 100

=Rs 550

Profit 20% =550 *20%

=110

Final selling price = Rs 660

Our naturally dyed children's clothing is more expensive than synthetic dyes. Our fabrics use natural dyes with antibacterial and antifungal properties, such as coconut husk and henna, instead of synthetic dyes that include harsh chemicals. This helps to protect children's fragile skin from infections, allergies, and irritation. In addition, our dyes create a hypoallergenic, breathable, and toxin-free finish, ensuring comfort and safety. While natural dyeing is more expensive because to its labour-intensive and environmentally responsible process, it ensures a long-lasting, skin-friendly, and chemical-free option for your children.

CONCLUSION

This study studied the viability of employing natural dye extracts from coconut husk and henna as sustainable colorants for children's clothes, with an emphasis on colour fastness to sunshine, rubbing, washing, and perspiration, as well as the pH of the dyed textiles. The goal was to assess the practical suitability and safety of these natural dyes for children's clothing.

Over seven days of sunshine testing, the colour intensity of both coconut husk and henna gradually decreased, demonstrating fading susceptibility. While coconut husk initially had higher colour fastness, both dyes eventually had a "very poor" rating, indicating the necessity for mordanting or protective finishes to improve light resistance.

Rubbing testing revealed a substantial disparity between dry and wet environments. Both dyes had "very poor" resistance while dry but "excellent" colour fastness when wet, underlining the importance of moisture on dye adhesion.

Unfortunately, washing tests found that both coconut husk and henna extracts had "very poor" colour fastness, with a staining level of one. This implies severe colour loss or bleeding during washing, posing a big challenge to the colours endurance in children's apparel, which must be washed frequently.

In contrast, perspiration testing produced more promising results. The staining level for coconut husk extract was 4, showing good sweat resistance. The henna extract fared considerably better, with a staining level of 5, indicating good

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resistance. This indicates that both colours are relatively stable in the presence of sweat, which is beneficial for children's clothing.

The pH tests revealed that coconut husk extract maintained a neutral pH, whereas henna extract added a small acidity. While both are generally considered safe, the slight acidity of henna may necessitate changes for optimal skin compatibility.

In summary, this study provided an environmentally responsible substitute for synthetic dyes by showcasing the possibilities of henna and coconut husk extracts as natural colourants for children's clothing.

REFERENCES

1. Ashis Kumar Samanta and Adwaita Konar Department of Jute and Fibre Technology, Institute of Jute Technology, University of Calcutta India. Dyeing of Textiles with Natural Dyes
2. Chozhavendan.S, Aniskumar. M, Pradeepa.S, Karthika Devi.S, Mathumitha.N Department of Biotechnology, V.S.B. Engineering College, Karur. REVIEW ARTICLE OF ACETIC ACID PRODUCTION BY WASTES AND STRAINS.
3. A. M. Daberao, Prof. P. P. Kolte, Prof. R. N. Turukmane Cotton Dying with Natural Dye
4. Gyanendra Tripathi, Mukesh Kumar Yadav, Prabhat padhyay, Shardendu ,Mishra, Natural dyes with future aspects in dyeing of Textiles
5. Keerthana.C, Dr. S. Geetha Margret Soundri, DYEING OF COTTON WITH NATURAL DYE EXTRACT FROM COCONUT HUSK AND PURPLE CABBAGE.
6. Lizamoni Chungkrang, Smita Bhuyan and Ava Rani Phukan. Natural Dyes: Extraction and Applications
7. Lizbeth Raju, Shwetha Nambiar, Dominic Augustine, Sowmya S. V., Vanishri C. Haragannavar1, Ashok Babu, Roopa S. Rao1, Lawsonia inermis (henna) extract: A possible natural substitute to eosin stain.
8. Nur Ain Abdul Ghafar1, Khairul Farihan Kasim, Nawwal Abdul Kadir3, Optimization of Natural Dye Extraction from Coconut Husk
9. Dr Reena Bhairam. To Study The Dyeability Of Natural Dye For Sustainable Fabric (Cotton).
10. Shinyoung Han, Yiqi Yang,Antimicrobial activity of wool fabric treated with curcumin
11. Shafqat Zaidi1, Abbas Zaidi, Syaifuddin Amir, Rana Mohsin Ali, Amira Alifia Syaban, Palm Art to therapeutic Properties: Henna-A Potential Medicinal Plant
12. Sonja Jordeva, Marija Kertakova, Silvana Zhezhova, Sashka Golomeova Longurova1 , Kiro Mojsov, DYEING OF TEXTILES WITH NATURAL DYES.
13. Sule Aslantas, Ozgur Golge, Miguel Ángel González-Curbelo and BulentKabak1, Determination of 355 Pesticides in Lemon and Lemon Juice by LC-MS/MSandGC-MS/MS
14. Suzylawati Ismail and Syahida Farhan Azha, Cotton Cloth: Diversified Applications beyond Fashion and Wearable Cloth

BOOK REFERENCE

15.The Impact and Prospects of Green Chemistry for Textile Technology
The Textile Institute Book Series

WEB REFERENCES

16. https://textilevaluechain.in/news-insights/the-importance-of-natural-dyes
17. https://ift.onlinelibrary.wiley.com/doi/full/10.1111/1750-3841.12434
18. https://sewport.com/fabrics-directory/cotton-fabric
19. Does cotton fabric impact environment?-Telangana Today
20. https://sewport.com/fabrics-directory/cotton-fabric
21. What Does Coconut Husk Contain? - Stellina Marfa

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

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ANNEXURE

Plate 8: End product