Development of Natural Dye Using Prosopis Juliflora Enhanced with Curcuma Zedoaria Fragrance

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Abstract
The Prosopis juliflora powder and curcuma zedoaria to naturally dye cotton fabric through tie-dye. The fabric was infused with fragrance and designed to offer mosquito repellent and antimicrobial properties. The goal was to create clothing for children that protects their sensitive skin. This eco-friendly approach leverages the natural benefits of the ingredients to provide a safe and functional textile solution for kids. The fabric's properties can help prevent mosquito bites and reduce the risk of microbial infections, making it a practical choice for baby clothing. This innovative textile project combines sustainability with functional design. The natural ingredients ensure a gentle touch on the skin while providing effective protection. This fabric can be a game-changer for parents seeking safe and eco-friendly clothing options. The unique blend of properties makes it an excellent choice for everyday wear. Additionally, the fabric's durability ensures it remains effective even after multiple washes. Overall, this project showcases the potential of natural ingredients in textile innovation.

Keywords: Prosopis Juliflora, Curcuma Zedoaria, Tie-Dye, Mosquito Repellent, Antimicrobial Properties, Eco-Friendly.

Introduction

Natural dyes are eco-friendly alternatives to synthetic dyes, reducing pollution and toxicity in textile processing.

Prosopis juliflora is a fast-growing, deep-rooted, thorny shrub or tree known for its adaptability to various climates and soils, rapid growth, and ability to fix nitrogen. The plant also exhibits medicinal properties, containing compounds like **alkaloids, flavonoids, and phenols** in its bark, leaves, pods, with traditional uses in treating respiratory issues, headaches, and other ailments.

Prosopis juliflora is commonly known as the mesquite tree or velvet mesquite and is an introduced, invasive species known for its vigorous growth, drought resistance, and ability to thrive in arid conditions, including saline and alkaline soils, but also causes significant environmental damage by outcompeting native flora,

consuming large amounts of groundwater, and reducing biodiversity. Introduced to India in the early 20th century, it was once seen as a tool for afforesting deserts but is now viewed as a disaster in many parts of the country. It grows as a shrub or small tree, is a source of wood and can aid in nitrogen fixation in the soil, but its negative impacts, such as the production of poisonous water, groundwater depletion, and the creation of dense thickets that inhibit native plant growth, have become a major concern.

Curcuma zedoaria, or white turmeric, is used in traditional medicine to aid digestion, reduce inflammation, and treat respiratory and skin disorders, and also has applications in cooking, aromatherapy, and cosmetics. Its rhizome has carminative, anti-spasmodic, and antimicrobial properties, while the essential oil is used in perfumery and skincare.

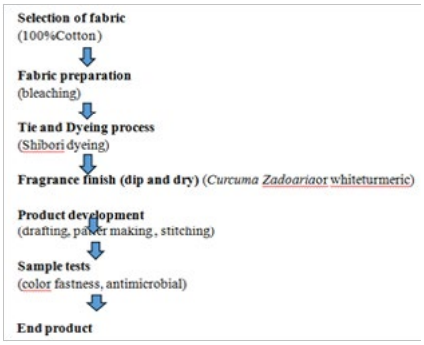
Skin & Wound Healing: Its paste is applied to wounds, bruises, and skin infections to speed up healing and reduce inflammation.

It is incorporated into face masks, creams, and other organic skincare products for its antibacterial and anti-inflammatory benefits.

Objectives

1. To extract natural dye from Prosopis juliflora using salt as mordant.
2. To apply the dye on cotton fabric suitable for children's garments.
3. To enhance the fabric with natural fragrance using Curcuma zedoaria (or white turmeric).
4. To test antimicrobial, colour fastness of the treated fabric.
5. To evaluate eco-friendly benefits as a substitute for chemical dyes and fragrances.

Methods/Methodology – Flow Chart



Selection of Fabric

100% cotton fabric is a popular choice for many reasons. It's breathable, keeping you cool and comfortable in warm weather. The softness of cotton makes it gentle on the skin, reducing irritation and discomfort. Cotton is durable and withstands repeated washing well, making it a practical choice for everyday wear.

The fabric's absorbent properties make it ideal for casual clothing, such as t-shirts and jeans. Cotton's versatility allows for various weights and weaves, from lightweight summer fabrics to heavier winter fabrics. It's easy to care for and maintain, making it a favorite among consumers.

Cotton's moisture-wicking properties keep you dry and comfortable, making it suitable for activewear and loungewear. The fabric's natural properties make it a healthy choice, reducing the risk of skin irritation and allergic reactions. Cotton is also biodegradable, reducing environmental impact.

The classic style of cotton fabric works well for all ages, from baby clothing to adult wear. It's a reliable choice for both everyday and special occasion wear. Cotton's adaptability ensures it's suitable for various garments and designs, from casual wear to formal wear.

Cotton fabric comes in a wide range of colors and patterns, making it a versatile choice for designers and consumers. The fabric's natural look and feel add to its appeal, making it a popular choice for home decor and sewing projects.

Overall, 100% cotton fabric is a timeless choice that offers comfort, durability, and style. Its natural properties make it a healthy and sustainable option, while its versatility ensures it's suitable for various applications. Whether you're looking for casual wear, activewear, or home decor, cotton fabric is a reliable and popular choice.

Cotton's benefits extend beyond its physical properties. It's also a sustainable and eco-friendly option, making it a popular choice for environmentally conscious consumers. With its numerous benefits and versatility, 100% cotton fabric remains a staple in many wardrobes and homes. Its comfort, durability, and style ensure it's a timeless choice that will continue to be popular for years to come.

Figure 1 Selection of Fabric (100% Cotton)

Fabric Preparation (Bleaching)

Fabric bleaching is a chemical process that removes natural or acquired color to whiten the fabric for dyeing, printing, or a pure white finish, using agents like hydrogen peroxide or chlorine bleach to break down color compounds. To use it, first identify the fabric type and use the appropriate bleach (oxygen or chlorine). For DIY use, dilute bleach with water, apply it to natural fabrics like cotton for a tie-dye effect, rinse thoroughly, and wash as usual.

(a) Required Material

- Water – 1000ml
- Soap solution – 50ml
- Bleach (chlorine or oxygen) – 150g
- 100% cotton material – 4 meter

(b) Method of Preparation

Fabric bleaching is a process that lightens or whitens fabrics, often to restore their original color, remove stains, or prepare them for dyeing. For bleaching process the selected fabric undergoes boiling in water for 15 to 20 minutes with soap solution and bleaching agent to achieve the bleached fabric for good absorption of dyes, thus this process enhances the overall appearance of the dyeing and the design of garment.

Figure 2 Bleaching Materials

Figure 3 Boiling Method

Figure 4 Bleached Fabric

Tie and Dye

Tie-dye is a resist-dyeing technique where fabric is folded, twisted, or crumpled and then bound with string or rubber bands to create patterns. The tied areas prevent the dye from reaching the fabric, resulting in unique and colourful designs when the binding is removed. The process involves applying dyes to the untied sections of the fabric, and can be used on various textiles and accessories. With historical roots in cultures like India and Japan (Shibori), tie-dye has evolved into a popular art form. The technique allows for endless creativity, from subtle pastels to vibrant hues. Each piece is distinct, making tie-dye a beloved method for crafting one-of-a-kind garments, accessories, and home decor items. The art form continues to inspire artists, designers, and enthusiasts worldwide, offering a creative outlet and a connection to traditional craftsmanship.

Preparation of the Dyeing Powder

The dyeing powder used by Prosopis juliflora: Prosopis juliflora is a fast-growing, deep-rooted, thorny shrub or tree known for its adaptability to various climates and soils, rapid growth, and ability to fix nitrogen. The plant also exhibits medicinal properties, containing compounds like **alkaloids, flavonoids, and phenols** in its bark, leaves, pods, with traditional uses in treating respiratory issues, headaches, and other ailments.

Figure 5 Prosopis Juliflora

Prosopis juliflora wood is typically ground into a fine powder or sawdust using a wood crusher or mill, and then dried in sunlight or an oven. This biomass powder can then be used for various purposes, such as a feedstock for pyrolysis to create bio-oil, as filler in composite materials, or for chemical extraction and analysis of its components. The utilization of Prosopis juliflora wood in this manner highlights its potential as a valuable resource. By converting the wood into bio-based products, it can contribute to sustainable development and reduce environmental impacts. Additionally, managing Prosopis juliflora through such applications can also help mitigate its invasive effects on ecosystems. The versatility of this biomass material opens up opportunities for innovation in energy, materials science, and chemical industries. Further research and development can unlock new applications, enhancing the economic and environmental benefits of utilizing Prosopis juliflora.

Figure 6 Prosopis juliflora Powder

(b) Tie and Dye Process – Required Material

- Prosopis juliflora powder – 200g
- Water – 1000ml
- 100% Cotton fabric – 4 meter
- Thread to tie

(c) Preparation of Tie and Dye

For tie-dye preparation, this process needs a cup of water, Prosopis juliflora wood powder, thread, and raw cotton fabric.

1. Mix water and Prosopis juliflora powder in a container to create a natural dye solution.
2. Fold and tie the fabric with thread into your desired design, ensuring the thread is tight to resist the dye.
3. Submerge the tied fabric in the container with the water and powder mixture.
4. Boil for 15–20 minutes, allowing the dye to penetrate the fabric evenly.

This natural dyeing technique can create unique patterns on your fabric, showcasing earthy tones and organic textures. The Prosopis juliflora wood powder adds sustainability to this project. After boiling, carefully remove the fabric, rinse, and dry to reveal your handmade tie-dye design. Experiment with different folding techniques, powder concentrations, and dyeing times to achieve varied results. This eco-friendly art form encourages creativity and self-expression.

Figure 7 Tie and Dye

Figure 8 Dyeing

Fragrance Finishing

Curcuma zedoaria, also known as White Turmeric or Zedoary, is a rhizomatous plant renowned for its distinct fragrance. Fragrance infusion involves extracting its aromatic compounds for use in various applications. To create an infused oil or extract, the rhizomes are typically dried and ground, then steeped in a carrier oil or solvent. This process allows the fragrance to meld with the oil, resulting in a potent and aromatic blend. The infused oil can be utilized in aromatherapy, promoting relaxation and well-being, or in perfumery, adding unique, earthy notes to fragrances. Additionally, Curcuma zedoaria's potential anti-inflammatory properties make it a valuable ingredient in skincare products. The fragrance of Curcuma zedoaria is often described as warm, spicy, and slightly sweet, making it a versatile component in various products. Its infusion can enhance candles, soaps, cosmetics, and fragrances, imparting a distinct aroma. In traditional medicine and cultural practices, the plant's aromatic properties have been valued for their therapeutic benefits. When working with Curcuma zedoaria, factors such as the quality of the rhizomes, infusion method, and blending with other fragrances are crucial to achieving the desired outcome. By harnessing the fragrance of Curcuma zedoaria, individuals can create unique and captivating products that showcase the plant's natural beauty and benefits. Whether used in aromatherapy, perfumery, or skincare, Curcuma zedoaria's fragrance infusion offers a range of creative possibilities. Its distinct aroma and potential benefits make it a valuable ingredient in various applications.

(a) Uses of Fragrance Finishing

Curcuma zedoaria, or White Turmeric, offers several benefits for the skin. Its anti-inflammatory properties can help soothe and calm irritated skin, while its antioxidant properties protect the skin from environmental stressors. Additionally, Curcuma zedoaria may help brighten the skin by reducing the appearance of dark spots and hyperpigmentation. Its antimicrobial properties can also combat acne-causing bacteria. Curcuma zedoaria can be a valuable ingredient for achieving healthier, more radiant skin. As with any new skincare ingredient, it's recommended to perform a patch test and consult a dermatologist if you have sensitive skin or allergies. By incorporating Curcuma zedoaria into your skincare routine, you may experience improved skin tone, reduced inflammation, and a more even complexion. With its natural and gentle properties, Curcuma zedoaria is a popular choice for those seeking a holistic approach to skincare. Regular use can lead to noticeable improvements in skin texture and appearance.

Figure 13 Curcuma Zedoaria, or White Turmeric

(b) Preparation of Fragrance

Curcuma zedoaria, also known as White Turmeric, is a versatile herb with a distinct aroma. Its fragrance can be extracted and utilized in various applications.

Methods for Extracting Fragrance

Essential Oil Extraction: Steam distillation or solvent extraction can be used to obtain essential oil from Curcuma zedoaria rhizomes. The essential oil can be used in aromatherapy, perfumery, or as a fragrance ingredient.

Hydrosol Extraction: Hydrosol is a byproduct of steam distillation, containing water-soluble compounds. It can be used as a fragrant ingredient in perfumes, cosmetics, or room sprays.

Infused Oil Extraction: Curcuma zedoaria rhizomes can be infused in a carrier oil to extract its fragrance. The infused oil can be used in massage oils, skincare products, or as a fragrant ingredient.

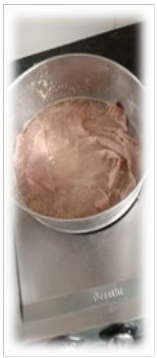


Figure 14 Fragrance of Curcuma Zedoaria or White Turmeric

Product Development (Drafting, Pattern Making, Stitching)

(a) Drafting

Drafting is the process of creating a detailed plan or template for a project, product, or garment. In the context of pattern making and fashion design, drafting involves:

- Measuring and calculating specifications

- Creating precise drawings or patterns
- Adding details such as seam allowances and grain lines

Drafting enables the creation of accurate and precise templates, allowing designers to bring their ideas to life.

(b) Pattern Making

Pattern making is the process of creating a template or blueprint for a garment, enabling designers to translate their ideas into physical clothing. It involves measuring, calculating, and drafting patterns to achieve accurate fit, efficient production, and consistent quality.

- Measuring and calculating garment specifications
- Drafting patterns for individual garment pieces
- Adding seam allowances and grain lines

Pattern making is a fundamental step in garment design and manufacturing, allowing designers to bring their creative visions to life.

Figure 15 Top Bodies Pattern

Figure 16 Jabla Pattern

Figure 17 Knicker Pattern

(c) Stitching

Stitching refers to the process of sewing or joining fabric pieces together using thread and needle. It involves creating a series of interconnected loops or stitches to:

- Join seams

- Decorate fabric
- Reinforce fabric edges

Stitching is a fundamental technique in garment construction, textile art, and repair, used to create a wide range of products, from clothing and accessories to home decor and embroidery.


Figure 18 Stitching

Sample Tests

S. No.	Color Fastness	Test
1.	 	0–2
2.	 	1.

(a) Color Fastness

Figure 19 Color Fastness – Before

Figure 20 Color Fastness – After

Figure 21 Antimicrobial Test
Figure 22 Yoke Frock

(b) Antimicrobial

Figure 23 Top and Skirt

Figure 24 Knicker

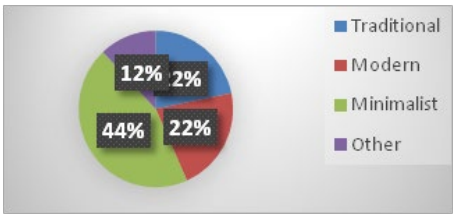
Figure 25 Skirt

Figure 26 Top Bodice

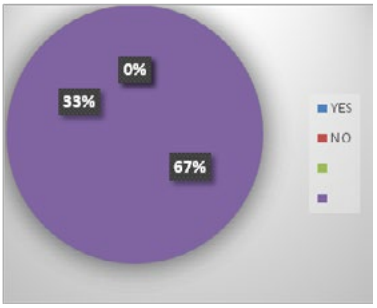
End Product

4. Qualitative Analysis (Survey)

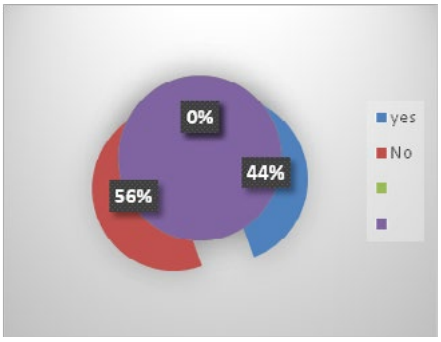
1. Have you ever heard of natural dyes from Prosopis juliflora?



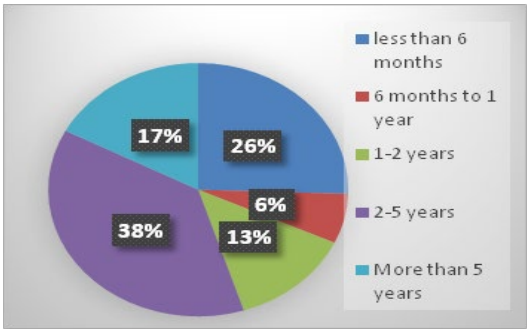
2. Have you ever used or owned a natural dye from Prosopis juliflora?



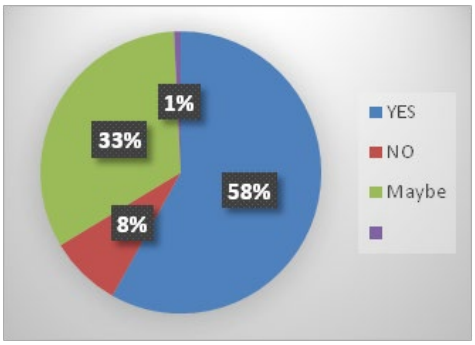
3. Which of the following designs would you prefer for a natural dye from Prosopis juliflora?



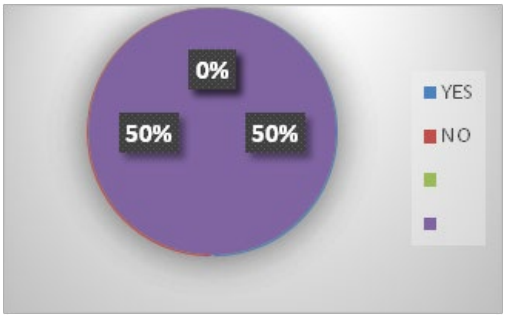
4. What do you think is the most suitable use for a natural dye from Prosopis juliflora?



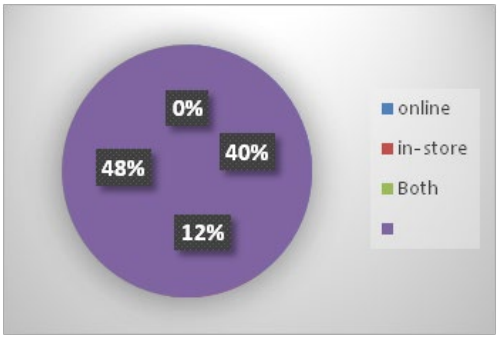
5. How long do you expect a natural dye from Prosopis juliflora to last?



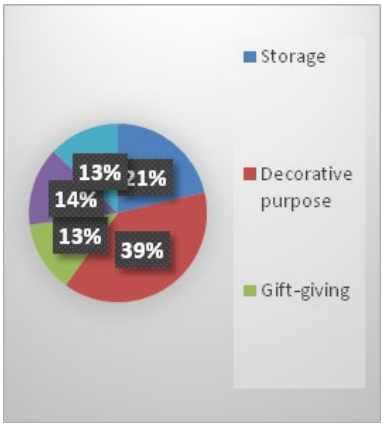
6. Do you think natural dyes from Prosopis juliflora are a sustainability option?



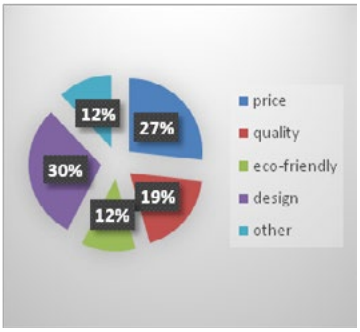
7. Would you prefer to buy natural dyes from Prosopis juliflora online or in-store?



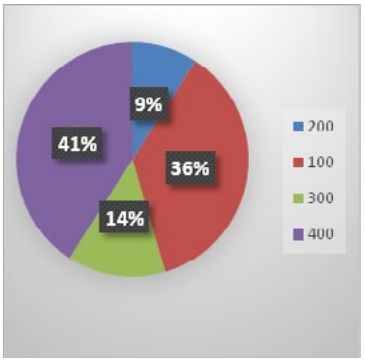
8. Would you consider switching from your current natural dye from Prosopis juliflora?



9. What factors would influence your decision to choose natural dyes from Prosopis juliflora over other options?



10. Guess the price range of fabric – natural dyes from Prosopis juliflora?



Conclusion

This innovative textile project successfully demonstrates the potential of natural ingredients like Prosopis juliflora powder and Curcuma zedoaria in creating eco-friendly, functional fabrics for children's clothing. The fabric's mosquito-repellent and antimicrobial properties provide effective protection for sensitive skin, while its durability ensures long-lasting performance. This sustainable approach showcases the potential for natural ingredients to transform the textile industry, offering a game-changing solution for parents seeking safe and eco-friendly clothing options for their kids.

References

1. E:\\2023\\Special Chhatrapal\\IJAS 19 (1) final.pmd
2. Alebeid, O. K. (n.d.). Developing UV protection of cotton fabric: A review. ResearchGate.
3. ZnO/carboxymethyl chitosan bionano-composite to impart antibacterial and UV protection for cotton fabric. ScienceDirect.
4. Abbasi, S. A. (n.d.). Prosopis (Prosopis juliflora): Blessing and bane. ResearchGate.
5. Article file from PLOS ONE journal. (n.d.). DOI: 10.1371/journal.pone.0044966.
6. Prosopis juliflora: Blessing and bane. (n.d.). PDF document.
7. Article from Redalyc, 93(950595002). (n.d.).
8. Study on Prosopis juliflora. (2021). Industrial Crops and Products, S0925346721006303.
9. Chapter in CABI Digital Library. (n.d.). DOI: 10.1079/9781800623644.0006.
10. Water abstraction study. (n.d.). Botswana University of Agriculture and Natural Resources Repository.

11. Curcuma zedoaria research. (n.d.). Google Scholar.
12. Curcuma zedoaria study. (2003). Food Chemistry, S0308814603000141.
13. Article from Proceedings of the Journal of Science and Language, 85. (2023).
14. Anti-angiogenesis effect of essential oil from Curcuma zedoaria in vitro and in vivo. (n.d.). ScienceDirect.
15. Study on Curcuma zedoaria. (n.d.). CORE.
16. Choochote, W. (n.d.). Larvicidal efficacy and biological stability of a botanical natural product: Zedoary oil-impregnated sand granules against Aedes aegypti (Diptera: Culicidae). ResearchGate.