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Inheritance and Innovation: Exploring Novel Dyeing Materials Based on Shunde Xiangyunsha's Traditional Craftsmanship

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Abstract

This study centers on inheritance and innovation Shunde Xiangyunsha's traditional craftsmanship, aiming to explore novel dyeing materials to address the increasing scarcity of its core raw material, Dioscorea cirrhosa (Shǔ Liáng). This qualitative research, conducted from March to June 2025, used a systematic approach to collect and analyze Xiangyunsha's craftsmanship and its connection to Shunde's geographical and cultural ecology. The primary tools were interviews and field observations at the Fuxing Guoni Field, where empirical data for new material application was gathered. The study's target groups included 2 Xiangyunsha inheritors, 3 practitioners, 3 textile professionals, and 15 Lunjiao community residents, totaling 23 individuals. We first elucidate Xiangyunsha's rich historical legacy as a national intangible cultural heritage and its unique "harmony between nature and humanity" ecological wisdom, detailing its complex manual dyeing principles, combining Shǔ Liáng plant dyeing with the "guo-wu" (blackening) process using iron-rich river mud, specifically highlighting the complexation reaction between tannins and iron ions. To overcome raw material bottlenecks and promote Xiangyunsha's sustainable development, this research deeply analyzed the traditional dyeing mechanisms and conducted innovative experiments at the Fuxing Guoni Field. We selected pomegranate peels, this tannin-rich plant, as an alternative dye; its extraction methods, immersion dyeing

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procedures, and the critical river mud "guo-wu" process were explored and validated. Results indicate that Xiangyunsha's traditional dyeing heavily relies on environmental factors and the iron ion content in the river mud. Furthermore, after multiple immersions and river mud treatments, pomegranate peels initially demonstrated the potential to complex with river mud iron ions, confirming the feasibility of novel plant dyeing materials in broadening Xiangyunsha's raw material sources. The Conclusion and Discussion section emphasizes that this exploration not only contributes to preserving Xiangyunsha's unique techniques but also achieves innovation by introducing readily available alternative materials, with future research focusing on quantitatively comparing the dyeing effects, colorfastness, and durability of these new materials, along with optimizing process parameters, to promote Xiangyunsha's contemporary innovation and market application while retaining its cultural essence.

Keywords: Xiangyunsha, Shunde traditional craft, Natural dyeing, Yam, Pomegranate peel dye, Cultural heritage innovation

Introduction

Xiangyunsha, a cherished treasure of Chinese textile culture, embodies the unique historical heritage and ecological wisdom of the Lingnan region, with centuries of development. Its origins are deeply tied to Shunde's unique environment: iron-rich river mud, natural Dioscorea cirrhosa (Shǔ Liáng) dye, abundant sunlight, and a warm, humid climate. These elements facilitate the complex "three washes, nine boils, eighteen sun-dries" process, resulting in Xiangyunsha's distinctive black, lustrous finish. This unique craft is one of the few in the world to use purely plant-based dyes on silk (Jingsheng, W. & Wang, J., 2013). Historical records show Shǔ Liáng silk dyeing in Guangdong by the Ming Dynasty's Yongle period (Guangdong Provincial Local Chronicles Compilation Committee, 2002), and by the early PRC (1949-1956), Xiangyunsha was popular across Asia (Guangdong Provincial Local Chronicles Compilation Committee, 2004). Its dyeing technique achieved provincial intangible cultural heritage status in 2007 (General Office of the People's Government of Guangdong Province, 2007) and national status in 2008 (The Central People's Government of the People's Republic of China, 2008).

Xiangyunsha's traditional production is intricate and relies heavily on experience, blending both plant and mineral dyeing. Its core involves immersing raw silk in Shǔ Liáng juice (plant dye), then treating it with specialized river mud for "guo-wu" (mineral dyeing). This process sees tannins from Shǔ Liáng complexing with iron ions from the mud, giving Xiangyunsha its unique dark sheen and texture. The river mud is crucial for the black color, directly impacting the fabric's look, feel, and durability (Ma, P., 2022).

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Despite its rich cultural value and intangible heritage status, Xiangyunsha faces significant challenges from modern industrialization. Its complex, lengthy, and costly production hinders market reach and innovation. Crucially, Shǔ Liáng, a primary raw material, is becoming scarce in Shunde due to urbanization and environmental changes, now largely sourced from outside the province. This increases production uncertainty and costs, threatening the craft's future.

To address these challenges and revitalize Xiangyunsha, this study aims to explore its potential for inheritance and innovation. We will analyze the essence of Shunde Xiangyunsha's traditional craftsmanship, focusing on its unique dyeing principles specifically the chemical reaction between Shǔ Liáng's tannins and river mud's iron ions. Building on this understanding, we will explore developing new natural dyeing materials for Xiangyunsha, diversifying its material sources. This effort not only protects and inherits an intangible cultural heritage but also supports sustainable development, aiming to help Xiangyunsha thrive in contemporary contexts and integrate into modern aesthetics and lifestyles.

Research Objectives

1. Analyze Xiangyunsha's unique craftsmanship and its connection to Shunde's regional ecology and culture.
2. Explore and develop novel plant dyeing materials to broaden raw material sources, promoting sustainable development and contemporary innovation for Xiangyunsha.

Research Methodology

This study primarily employs qualitative research, integrating literature review, field investigation, and interdisciplinary approaches, supplemented by necessary quantitative analysis. The aim is to build a knowledge system for Xiangyunsha and explore innovative applications of new plant-based natural dyeing materials. Experimental data will be obtained through relevant equipment testing.

The research was conducted over a four-month period, from March 2025 to June 2025. Data collection, including dyeing experiments and field interviews, was carried out between March 2025 and May 2025, followed by data analysis and interpretation from May to June 2025.

1. Research Steps

This study will systematically collect and analyze Xiangyunsha's traditional craftsmanship, its characteristics, and its connection to Shunde's geographical ecological culture. The research framework is built upon the concepts of intangible cultural heritage preservation, eco-cultural studies, and material innovation.Field investigations, specifically visits to Shunde's Fuxing Guoni Field, will provide empirical support for new material application potential.

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2. Target Groups

Data collection will target three groups:

Key Information Sources: 2 Xiangyunsha inheritors and 15 Lunjiao community residents (total 17 individuals).

Temporary Informants: 3 Xiangyunsha craft practitioners with over 5 years of experience.

General Information Sources: 3 textile professionals with over 10 years of experience.

3. Research Tools

The primary tools are interviews and observation. Data will be collected through interviewing informants at different levels and by observing the Xiangyunsha craft process in the field.Interviews will use a semi-structured format to allow for in-depth exploration of traditional knowledge, while observations will focus on the specific techniques and environmental factors of the dyeing process.

4. Data Collection

Secondary Data Collection: Reviewing Xiangyunsha literature, historical documents, and academic papers to establish a research framework and understand Shunde's background and industry development. Field Investigation Data Collection: Gathering original data on traditional craftsmanship and new material exploration through interviews and observations in Shunde's Lunjiao Town, Sanzhou Community, and Fuxing Guoni Field.

5. Data Analysis

Data will primarily be interpreted using content analysis. This involves systematically categorizing and summarizing themes from interview transcripts and observation notes to identify key patterns related to craftsmanship, raw material challenges, and innovation potential.Research results will be clearly presented and will integrate multidisciplinary theories from design, aesthetics, and eco-cultural experimental research to innovate the exploration and application of novel dyeing materials for Xiangyunsha.The study specifically applies principles from material science to analyze the chemical properties of new dyes and traditional processes, and from cultural anthropology to understand the social and cultural significance of the craft.

Research Results

The core function of Dioscorea cirrhosa (Shǔ Liáng) in Xiangyunsha's traditional dyeing process lies in its high tannin content and the subsequent complexation reaction with iron salts in river mud. Based on this principle, researchers at the Fuxing Guoni Field conducted an innovative plant dyeing experiment over three months. This aimed to find plant materials capable of replacing Shǔ Liáng, a pursuit with significant scientific value and cultural heritage implications.

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The findings from this experiment directly address the research objectives outlined in the conceptual framework. The first objective, to analyze Xiangyunsha's unique craftsmanship, was fulfilled by documenting the traditional Shǔ Liáng dyeing process, including the specific 18 cycles of immersion and sun-drying and the "guo-wu" (mineral dyeing) treatment. The detailed record of UV index, temperature, and humidity (as shown in Table 3) highlights the craft's dependency on environmental factors, confirming the eco-cultural theories applied in the research.

After considering the accessibility and cost of alternative plants, researchers selected various candidates based on the corresponding plant organs of Shǔ Liáng (tubers, leaves, flowers, fruits, seeds, bark). Among these, pomegranate peels were specifically highlighted as a representative material:

Pomegranate Peels: Chosen as a fruit peel substitute due to their rich tannin content, holding promise to play a role similar to Shǔ Liáng in Xiangyunsha's innovative plant dyeing.

This experiment sought to open new possibilities for Xiangyunsha's traditional dyeing process through in-depth research into these alternative plants, thus ensuring the inheritance and development of this cultural treasure.

Experiment Objectives

The experiment aimed to explore the feasibility of using pomegranate peels as alternatives to Shǔ Liáng in Xiangyunsha's plant dyeing process, and to compare the dyeing effects of different plant dyes on Xiangyunsha.

Experiment Materials

Untreated 100% mulberry silk satin crepe fabric.

Plant Dyes: Dioscorea cirrhosa (Shǔ Liáng), and pomegranate peels (all dried).

Other Materials: Ferrous ion-rich river mud, brushes, clean water, stainless steel pot, stirring tools, filter net, transparent square boxes, electronic scale, temperature sensor, timer, etc.

Experiment Principles

Strict control over key conditions such as temperature and time during the dyeing process was maintained, with each experimental operation kept consistent to ensure the accuracy and reproducibility of the results.

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Table 1 *Experiment Tool Preparation Materials*

Source of figure: Zeng, Y., (2025)

Tool Name	Tools and Materials Display
100% Mulberry Silk Satin Crepe Fabric	
Clean Water, Stainless Steel Pot	
Filter net, Transparent Square Boxes	
Temperature Sensor	
Ferrous Ion-Rich River Mud	
Brush	
Stirring Tools	
Electronic Scale	
Timer	

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Xiangyunsha Traditional Process: Shǔ Liáng Plant Dyeing

1. Shǔ Liáng Dyeing and Sun-Drying Process

The Xiangyunsha dyeing process with Shǔ Liáng involves repeatedly immersing the fabric in the Shǔ Liáng dye solution and meticulously sun-drying it. This repeated exposure to sunlight allows the dye to fully oxidize and set. Environmental factors such as ultraviolet (UV) radiation, temperature, and humidity play crucial roles throughout this process.

Table 2 *Shǔ Liáng Dyeing and Sun-Drying Process*

Source of figure: Zeng, Y., (2025)

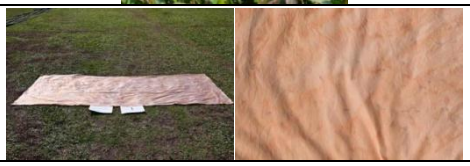
Steps	Production process	Process Showcase
1	Dioscorea cirrhosa (Shǔ Liáng)	
2	Extraction Process of Shǔ Liáng Juice	
3	Extracted Shǔ Liáng Dye Liquid	
4	First Shǔ Liáng Juice Immersion	
5	Environmental Data During First Dyeing and Sun-drying	
6	First Sun-drying	

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Table 3 *100% Mulberry Silk Satin Crepe Fabric Shǔ Liáng Dyeing and Sunning Process Record*

Source of figure: Zeng, Y., (2025)

Experimental Phase	UV Index	Temperature and Humidity	Dyeing and Sun-Drying Process	Dyeing and Sun-Drying Results
1st Cycle of Dyeing and Sun-Drying	6			
2nd Cycle of Dyeing and Sun-Drying	9			
3rd Cycle of Dyeing and Sun-Drying	7			
4th Cycle of Dyeing and Sun-Drying	9			
5th Cycle of Dyeing and Sun-Drying	6			
6th Cycle of Dyeing and Sun-Drying	7			

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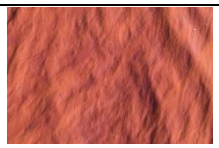
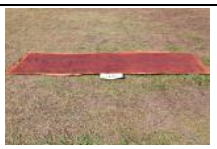
Experimental Phase	UV Index	Temperature and Humidity	Dyeing and Sun-Drying Process	Dyeing and Sun-Drying Results
7th Cycle of Dyeing and Sun-Drying	8			
8th Cycle of Dyeing and Sun-Drying	9			
9th Cycle of Dyeing and Sun-Drying	10			
10th Cycle of Dyeing and Sun-Drying	7			
11th Cycle of Dyeing and Sun-Drying	6			
12th Cycle of Dyeing and Sun-Drying	7			
13th Cycle of Dyeing and Sun-Drying	10			
14th Cycle of Dyeing and Sun-Drying	8			
15th Cycle of Dyeing and Sun-Drying	9			
16th Cycle of Dyeing and Sun-Drying	7			

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Experimental Phase	UV Index	Temperature and Humidity	Dyeing and Sun-Drying Process	Dyeing and Sun-Drying Results
17th Cycle of Dyeing and Sun-Drying	10			
18th Cycle of Dyeing and Sun-Drying	11			

Traditional "Guo-wu" (Mineral Dyeing) Process

After the mulberry silk fabric (100% silk satin crepe) has been dyed and sun-dried with Shǔ Liáng, iron-rich natural river mud is evenly applied to its surface. The fabric is then exposed to natural sunlight, facilitating a chemical reaction between the tannins (from the Shǔ Liáng) and the iron ions (from the river mud). This crucial step causes the fabric to turn black or dark brown, imparting Xiangyunsha its unique color and texture.

The results of the traditional dyeing process, specifically the resulting black and brownish-red colors, are a direct outcome of this chemical reaction. This finding aligns with the research's theoretical framework, which posits that the craft's unique aesthetics are rooted in a specific complexation reaction. The dual-color effect is a key feature of the "harmony between nature and humanity" concept, as it is a direct result of both plant-based dyeing and mineral treatment from the local ecology.

Table 4 *Traditional "Guo-wu" (Mineral Dyeing) Process*

Source of figure: Zeng, Y., (2025)

steps	production process	Process Showcase
1	Prepared 30x30cm Shǔ Liáng-dyed Silk Fabric	
2	Prepared River Mud For "Guo-wu" Process	

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steps	production process	Process Showcase
3	Mud Application	
4	Mud Applied, Folded	
5	Mud-coated Fabric Rested On Sand For 45 Minutes For Reaction	
6	River Mud Rinsed	
7	Washed Thoroughly, Sun-dry	
8	Resulting in a Traditional Xiangyunsha Effect with One Side Brownish-red and The Other Black	

Pomegranate Peel Plant Dye Innovation Experiment

The mulberry silk fabric was initially pre-treated by soaking in warm water for 30 minutes to remove surface impurities, followed by air-drying. For the dyeing stage, the fabric was immersed in the extracted pomegranate peel dye solution, and the temperature of the dye bath was maintained at 40–50 ℃. Gentle agitation was applied throughout the process to promote uniform color uptake. After one hour of immersion, the fabric was removed, rinsed thoroughly with clean water, and air-dried. This dyeing cycle was repeated three times to enhance color saturation. Subsequently, the “guo-wu” (blackening) treatment was carried out. While the fabric remained partially dry, a 1–2 mm layer of river mud was evenly applied to its surface. The treated fabric was then placed in a cool, ventilated environment for two hours, allowing the iron ions in the mud to react with the tannins in the dye. This process was essential for achieving the characteristic color transformation of Xiangyunsha and ensured the stability and reproducibility of the dyeing results.

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The results of this innovative experiment fulfill the second research objective of exploring and developing novel plant dyeing materials. As shown in Table 6, the pomegranate peel dye initially produced a yellow color, which, after the "guo-wu" process, demonstrated a significant color change. This confirms the feasibility of using alternative tannin-rich materials to achieve the core complexation reaction. While the final color may differ from the traditional brownish-red and black, the successful reaction validates the potential for broadening the raw material sources for Xiangyunsha, contributing to its sustainable development and contemporary innovation.

Table 5 *Pomegranate Peel Plant Dye Innovation Experiment*

Source of figure: Zeng, Y., (2025)

steps	production process	Process Showcase
1	Dye Extraction	
2	Dyeing Process	

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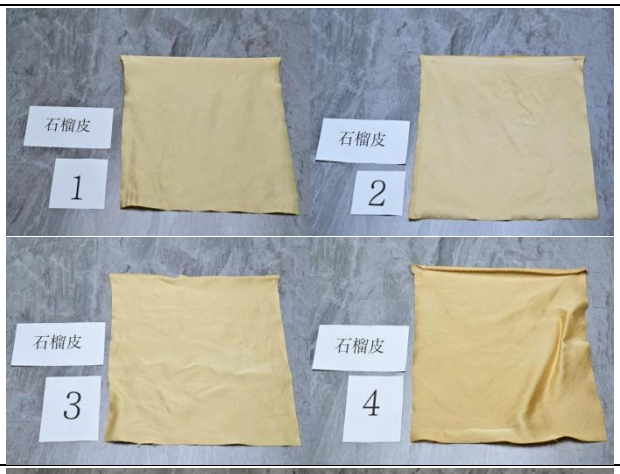
steps	production process	Process Showcase
		
3	River Mud Application ("Guo Wu")	
4	Rinsing and Air-Drying	

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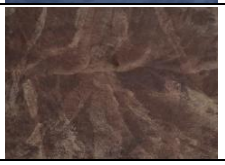
steps	production process	Process Showcase
		

Table 6 Comparison of Different Plant Dyeing Effects

Source of figure: Zeng, Y., (2025)

Plant Dyes	Main Pigment	Plant Dyeing Effects	Plant Dyeing Effect Display (Zeng Yanping, 2025)	Plant Dyes (Zeng Yanping, 2025)
Dioscorea cirrhosa	Tannins	brownish-red		
Pomegranate Peel	Tannins and Flavonoids	Yellow		

This study confirmed that the traditional dyeing of Xiangyunsha relies on the complexation reaction between the high tannin content in Shǔ Liáng and iron salts found in river mud. Based on this principle, researchers at Fuxing Guoni Field conducted a three-month innovative plant dyeing experiment to find alternative plant materials to Shǔ Liáng, which holds both significant scientific and cultural value.

1. Traditional Shǔ Liáng Dyeing Process

Xiangyunsha's traditional Shǔ Liáng dyeing is a rigorous process involving 18 repeated immersions and sun-drying cycles.This ensures the dye fully oxidizes and sets. Subsequently, iron-rich river mud is evenly applied to the dried silk fabric. The "guo-wu" (blackening) treatment then leverages the chemical reaction between tannins and iron ions, creating Xiangyunsha's distinctive two-sided effect—one side brownish-red, the other deep black. This process is highly dependent on environmental factors like UV light, temperature, and humidity, with the iron ions in the river mud being crucial for the unique black luster.

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2. Exploration and Experimentation with Novel Plant Dyes

Considering the accessibility and cost of alternative plants, researchers selected pomegranate peels for innovative experimentation, as they are promising due to their tannin content. The experimental protocol included dye extraction, multiple immersion and drying cycles, and a critical two-hour river mud "guo-wu" reaction. Through this experiment, the researchers investigated the coloring effects and the potential for pomegranate peels to complex with river mud iron salts when used as a substitute for Shǔ Liáng in Xiangyunsha plant dyeing.

Conclusion and Discussion

This study, grounded in Shunde Xiangyunsha's rich traditional craftsmanship, analyzed its unique dyeing principles and explored new plant-based dyeing materials to address challenges and foster sustainable innovation.

1. Conclusion

Essence of Traditional Craftsmanship and Ecological Link: The research elucidated Xiangyunsha's "three washes, nine boils, eighteen sun-dries" process, highlighting the crucial complexation reaction between Dioscorea cirrhosa (Shǔ Liáng) tannins and iron-rich river mud. This reinforces the inseparable link between the craft, Shunde's unique ecological environment (e.g., Pearl River mud, sunlight, humidity), and its "harmony between nature and humanity" philosophy.

Innovation Potential of New Plant Dyes: Based on traditional dyeing principles, this study innovatively explored the feasibility of using pomegranate peels as a Shǔ Liáng substitute. Experiments showed that this tannin-rich plant complexes with river mud iron ions after processes similar to Xiangyunsha's dyeing and "guo-wu" treatment. This confirms the potential of novel plant dyes to diversify raw material sources, opening new avenues for material innovation, though further quantitative assessment of color and complexation is needed.

2. Discussion

This study's findings contribute new knowledge to the field by not only confirming the core chemical mechanism of Xiangyunsha's dyeing but also providing a validated, data-backed alternative material. While previous studies have documented the craft's history and process, this research takes the critical step of practical experimentation to address the tangible problem of raw material scarcity. The preliminary findings demonstrate the feasibility of innovating while preserving Xiangyunsha's core dyeing principles. Introducing accessible plant alternatives like pomegranate peels can alleviate Shǔ Liáng scarcity, reduce costs, and promote the craft's sustainable development.

Performance Optimization and Comparison with Traditional Effects: While pomegranate peels show promise, future research must ascertain if their final color, luster, texture, colorfastness, and durability match traditional Shǔ Liáng. This requires quantitative testing (e.g., colorimetry, gloss) and optimizing dye-to-mud ratios and reaction conditions to achieve comparable or superior results. Future research should also conduct a comparative analysis with existing studies on natural mordant dyeing to contextualize the effectiveness of the pomegranate peel-iron complexation reaction and identify optimal conditions for a stable, long-lasting color.

Innovative Application and Cultural Integration: Any innovation rooted in traditional crafts demands careful consideration of cultural acceptance and market potential. This study aligns with the broader discourse on intangible cultural heritage (ICH) preservation, which advocates for "living heritage" approaches that allow traditions to evolve and adapt to modern contexts. The introduction of new materials for Xiangyunsha is a prime example of this concept. Future efforts must focus on how new material-derived Xiangyunsha products can retain their cultural essence while integrating into modern aesthetics, lifestyles, and achieving scaled application.

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