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Analyzing the Indigenous Knowledge and Traditional Practices in Sindh:

A Critical Examination of Ajrak and the Case for Synthetic-Free Natural Dyeing

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Abstract:

Ajrak, a distinguished symbol of Sindhi cultural identity, embodies centuries of indigenous knowledge and traditional craftsmanship rooted in the Indus Valley Civilization (c. 2500–1500 BCE). This ancient textile art form is characterized by intricate block-printing techniques applied to handwoven cotton fabric using natural dyes derived from indigo, madder, and medicinal herbs. The present study examines the cultural, historical, and environmental significance of traditional Ajrak-making, with particular emphasis on identifying the health and ecological consequences of the growing adoption of synthetic chemical dyes—specifically ferrous sulphate (Hirakas)—in contemporary Ajrak production. A qualitative methodology was employed, incorporating ethnographic field visits to Ajrak production sites (karkhānas) across Sindh, semi-structured interviews with ten artisans, and a critical review of peer-reviewed literature. Findings reveal that while artisans acknowledge and value natural dyeing traditions, increasing economic pressures and the accessibility of synthetic dyes have led to widespread substitution that poses documented risks to artisan health and environmental sustainability. Prolonged dermal exposure to ferrous sulphate has been associated with contact dermatitis, skin peeling, and chronic irritation among artisans. This paper concludes with policy-oriented recommendations for reinstating natural dyeing practices, supported by institutional partnerships, eco-labelling, and market development for sustainably produced Ajrak. Such measures not only preserve a living cultural heritage but also align Ajrak production with global sustainable fashion imperatives and climate action goals (SDG 12, SDG 13).

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1. INTRODUCTION

As global discourse intensifies around sustainability and environmentally responsible production, it is instructive to recognize that numerous traditional crafts have coexisted harmoniously with nature for millennia—long before the vocabulary of "green" or "eco-friendly" entered mainstream usage. The province of Sindh, Pakistan, is home to one of the most storied of these traditions: the art of Ajrak textile printing. Crafted by passionate and highly skilled artisans since antiquity, Ajrak is far more than decorative cloth—it is a living archive of ecological wisdom, spiritual belief, and cultural continuity (Jan & Shar, 2019).

Ajrak is a handmade fabric distinguished by its bold symmetrical patterns and vibrant colour palette, typically dominated by deep red, black, white, and indigo. Traditionally worn as a shawl, turban, or scarf, Ajrak serves as a symbol of respect, heritage, and pride in Sindhi society. It is presented as a token of honour to guests and dignitaries, and its presence marks weddings, religious ceremonies, and political occasions. The very word "Ajrak" carries semantic weight: its derivation has been traced to the Arabic *Ajr* (meaning "reward" or "noble deed"), the Arabic/Persian *Azrak* (meaning "blue"), and the Persian *Ajar/Ajor* (meaning "brick"), each etymology reflecting a facet of the textile's identity (Bilgrami, 2000; Shoaib, 2022).

The antiquity of Ajrak is supported by archaeological evidence. The Indus Valley Civilization, flourishing between approximately 2500 and 1500 BCE, produced one of the world's earliest urban cultures. Among the most celebrated artefacts recovered from Mohenjo-daro is the so-called *Priest-King* statuette, whose draped shawl features trefoil motifs strikingly similar to those found in contemporary Ajrak textiles—suggesting that the tradition of resist-printed textile art has deep roots in the Indus region (Marshall, 1931; Bilgrami, 2000). Further historical elaboration of the craft occurred following the

Arab conquest of Sindh in the 8th century CE, which introduced new artistic influences and embedded Ajrak within Islamic cultural frameworks (Sahapedia, 2023).

Despite its venerable history and ecological basis, Ajrak-making is under threat. The incursion of synthetic chemicals—particularly ferrous sulphate (locally called *Hirakas*)—into the dyeing process has compromised the craft's sustainability credentials and created documented health hazards for artisans. This paper critically analyzes this tension, grounding its inquiry in ethnographic fieldwork and a review of recent scholarship on textile sustainability, artisan occupational health, and cultural heritage preservation.

2. LITERATURE REVIEW

2.1 Historical and Cultural Origins of Ajrak

The historiography of Ajrak is rich and multi-layered. Bilgrami's (2000) foundational monograph *Sindh Jo Ajrak* remains the definitive scholarly reference on the craft's origins, techniques, and symbolism, documenting its lineage from the Indus Valley period through the Mughal era and into the 20th century. The Khatri community, whose name translates as "one who fills or changes colours," is credited with systematizing block-printed Ajrak in Sindh; a branch of this community also established Ajrak production in Kutch, India, following their migration in the 16th century, where they used natural dyes and water from the Dhamadka River (Bilgrami, 2000).

The trefoil motif—visible on the Mohenjo-daro Priest-King statue, on Sumerian bulls in Mesopotamia, and in Ajrak patterns—has been interpreted as a cosmological symbol representing the unity of the Sun, Water, and Earth. This symbolic continuity across civilizations underlines the deep cultural resonance of Ajrak as a form of visual and spiritual communication (Bilgrami, 2000; Marshall, 1931).

Recent scholarship has reinforced the craft's status as an intangible cultural heritage. Ahmed et al. (2023) documented the role of Ajrak in Sindhi social rituals, arguing that its gifting practices constitute a system of social bonding with parallels to potlatch

economies. Khan and Siddiqui (2024) further demonstrated through community surveys that Ajrak is perceived by Sindhi youth as a non-negotiable marker of ethnic identity, suggesting strong social resilience for the craft despite economic pressures.



2.2 Natural Dyes in Traditional Textiles

Natural dyes have been employed in South Asian textiles for at least four millennia. Tamilarasi and Banuchitra (2023) provide a comprehensive taxonomy of natural dye sources, classifying them by botanical family, extraction method, and mordanting behaviour. The principal dyes employed in Ajrak—indigo (*Indigofera tinctoria*), madder (*Rubia tinctorum*), and myrobalan (*Terminalia chebula*)—are all well-characterized in the phytochemical literature and are regarded as non-toxic to humans and the environment when used without synthetic mordants (Tamilarasi & Banuchitra, 2023; Samanta & Agarwal, 2009).

More recent work has expanded the pharmacological profile of these dyes. Rathore and Sharma (2024) demonstrated the antimicrobial properties of indigo-based textiles, while Verma et al. (2023) showed that madder-dyed fabrics exhibit UV-protective properties comparable to commercial sunscreen-treated textiles. These findings carry commercial implications for natural-dyed Ajrak, supporting arguments for premium market positioning based on functional as well as aesthetic attributes.

The mordanting process is central to the durability of natural dyes. In traditional Ajrak-making, myrobalan serves as the primary mordant in a cold-bath process known as *Kasanu*, which prepares the cotton fibres for dye uptake. Alum (phitkari) is subsequently

employed as a secondary mordant to fix red and warm tones. Both substances are acknowledged as environmentally acceptable mordants with low toxicity profiles (Samanta & Agarwal, 2009; Tamilarasi & Banuchitra, 2023).



2.3 Synthetic Dyes and Occupational Health Risks

The partial or complete substitution of natural dyes with synthetic alternatives is a documented trend across South Asian craft textile industries (Raza et al., 2024). The drivers of this transition include lower cost, greater colour consistency, shorter production cycles, and more reliable supply chains. In the context of Ajrak, ferrous sulphate ($FeSO_4 \cdot 7H_2O$)—commercially referred to as *Hirakas*—has increasingly replaced the traditional iron-fermentation black dye, a laborious but non-toxic process described in Bilgrami's (2000) technical appendix.

The occupational health literature on synthetic dye exposure is unambiguous. Paste et al. (2023) conducted a cross-sectional study of dyeing and printing workers in Mumbai's textile industry and found that over 52% of participants reported dermatological symptoms attributable to chemical exposure, with symptoms concentrated on the hands and forearms. Risk was significantly elevated among workers with more than five years

of occupational exposure. Sulphate compounds, in particular, were associated with contact dermatitis, skin fissuring, and allergic sensitization (Paste et al., 2023).

Zhao and Chen (2024) reviewed global literature on ferrous sulphate in textile processing and concluded that, while the compound is classified as low-acutely toxic, chronic occupational exposure without adequate personal protective equipment (PPE) constitutes a meaningful dermatological and systemic health risk. Their analysis found that artisan-scale production environments—characterized by minimal ventilation, absence of PPE, and prolonged skin contact—amplify these risks substantially. This finding is directly relevant to the karkhāna settings documented in the present study.

Environmental concerns are equally significant. Effluent from synthetic-dye baths contains heavy metal ions and sulphate compounds that alter soil pH and aquatic chemistry when discharged untreated into irrigation canals and waterways—a prevalent practice in rural Sindh (Ali et al., 2023). The cumulative environmental burden of synthetic dye use in small-scale craft production is thus a legitimate concern for regional ecological health



2.4 Sustainable Fashion and Heritage Craft

The global sustainable fashion movement has created unprecedented market opportunities for natural-dyed heritage textiles. Hussain and Malik (2025) analyzed consumer willingness-to-pay for certified eco-crafts in South Asian export markets and found a statistically significant premium of 18–27% attached to products carrying credible sustainability certification. Baloach and Noorani (2024) specifically examined

Ajrak's potential within the slow fashion economy, arguing that its complete value chain—from hand-harvested plant dyes to hand-blocked printing and hand-loomed cloth—constitutes an exemplary circular fashion model.

Internationally, the United Nations Environment Programme (2024) has identified traditional craft textiles as priority sectors for green economy transition in lower-middle-income countries, noting their potential to simultaneously deliver SDG 8 (decent work), SDG 12 (responsible consumption), and SDG 13 (climate action) outcomes. The alignment of natural-dyed Ajrak with this framework positions the craft as a strategic asset for Pakistan's creative economy, provided that the integrity of traditional practices is maintained.

3. RESEARCH METHODOLOGY

3.1 Research Design

This study adopts an interpretivist qualitative paradigm, recognizing that the knowledge embedded in traditional craft practices is best accessed through sustained engagement with practitioners rather than through quantitative measurement. The research design draws on ethnographic principles, combining direct observation of Ajrak production with semi-structured interviewing, thereby allowing emergent themes to surface organically from artisan narratives (Creswell & Poth, 2023).

3.2 Data Collection

Primary data were collected during fieldwork conducted between January and March 2025 across five Ajrak-producing localities in Sindh: Bhitshah, Matiari, Hala Naka, Tando Allahyar, and Hyderabad Rural. A purposive sample of ten artisans was selected to ensure representation across gender (eight male, two female), age (28–55 years), and years of experience (6–30+ years). Semi-structured interviews, conducted in Sindhi with the assistance of a local interpreter, focused on: (a) raw material sourcing and dye

preparation; (b) specific use of ferrous sulphate in the black dye process; (c) self-reported health symptoms; and (d) awareness of and attitudes toward natural dyeing alternatives.

Secondary data were drawn from peer-reviewed journal articles, institutional reports, ethnographic monographs, and heritage documentation published between 2000 and 2025, with priority given to sources from 2023 to 2026 to ensure currency of evidence.

3.3 Data Analysis

Interview transcripts were subjected to thematic analysis following the six-phase framework of Braun and Clarke (as cited in Creswell & Poth, 2023): familiarization with data, generation of initial codes, theme construction, review of themes, definition and naming of themes, and report production. Atlas.ti conceptual mapping was used to organize emerging themes around the axes of *health impact*, *economic constraint*, *cultural knowledge*, and *sustainability readiness*.

4. FINDINGS

4.1 Ferrous Sulphate Use Among Interviewed Artisans

All ten artisans interviewed confirmed the regular use of commercially produced ferrous sulphate (*Hirakas*) in their Ajrak dyeing process, specifically for producing the characteristic black colour. Table 1 presents a summary of usage quantities, reported purposes, health symptoms, and protective behaviours documented during fieldwork.

Table 1. *Ferrous Sulphate Usage, Health Symptoms, and Protective Behaviours Among Interviewed Artisans*

Artisan Name	Location	$FeSO_4$ per Batch	Purpose	Skin Symptoms	Health Effects	Protective Measures
Ali Hassan	Bhitshah	500g	Dye fixation & colour enhancement	Dryness, irritation, mild rashes	Skin discomfort, occasional swelling	Occasional gloves; limited
Meer Hassan	Matiari	750g	Deep indigo & red shade development	Itching, redness, slight rashes	Frequent discomfort, skin peeling	None; occasional hand-washing

Artisan Name	Location	$FeSO_4$ per Batch	Purpose	Skin Symptoms	Health Effects	Protective Measures
Ishaq Dar	Sehto Village	600g	Dye fixation & colour richness	Peeling, mild discolouration	Minor allergic reactions, discolouration	Rarely gloves; prefers brushes
Fatima Bibi	Bhitshah	550g	Fabric depth & colour longevity	Burning sensation, redness, irritation	Long-term exposure risk; discomfort after handling	Occasional gloves; inconsistent
Ghulam Nabi	Matiari	800g	Colour fixation & fastness	Cracked skin, occasional burning	Burning sensation, cracked skin	No consistent PPE
Noor Ahmed	Hala Naka	650g	Colour depth & dye fixation	Itching, dryness	Burning, eye irritation	Cloth wraps; no gloves
Yasmeen Parveen	Tando Allahyar	700g	Black & deep red tone development	Peeling, redness	Burning sensation, long-term dryness	Thin gloves occasionally
Sajid Hussain	Hyderabad Rural	600g	Dye fixation; contrast sharpening	Rash on wrists and fingers	Minor inflammation; discomfort with water contact	Frequent hand-washing; no PPE
Sobia Junejo	Nasarpur	500g	Dye stabilization	Red patches, itchiness	Frequent irritation; contact dermatitis signs	Plastic gloves; not durable
Faizan Qureshi	Tando Adam	750g	Colour fastness & penetration	Cracking skin, slight bleeding	Chronic irritation, skin flaking	No regular PPE; ointments post-work

Note. *$FeSO_4$ = ferrous sulphate; PPE = personal protective equipment. Data from field interviews, January–March 2025.*

5. DISCUSSION

5.1 Quantity of Use and Exposure Risk

Artisans in this study reported using between 500g and 800g of ferrous sulphate per dye batch, with Ghulam Nabi of Matiari recording the highest usage. A positive correlation was observed between quantity of ferrous sulphate used and severity of reported skin symptoms: artisans using 700g or more per batch were more likely to report chronic symptoms such as persistent cracking, bleeding, and long-term dryness, consistent with

patterns of cumulative chemical overexposure documented in occupational health literature (Paste et al., 2023; Zhao & Chen, 2024).

The absence of adequate PPE—gloves, protective sleeves, respiratory masks, and eye protection—was near-universal in the sample. This finding aligns with Raza et al.'s (2024) pan-South Asian survey of craft textile workers, which found PPE adoption rates below 20% in artisan-scale operations, attributable to cost, discomfort during manual work, and lack of institutional mandate.

5.2 Health Impacts and Cumulative Exposure

The most commonly reported symptoms—dryness, itching, peeling, and redness—are consistent with the clinical presentation of irritant contact dermatitis (ICD), the most prevalent occupational skin disease globally (Zhao & Chen, 2024). In the cases of Fatima Bibi and Meer Hassan, symptom duration and severity suggest possible progression toward allergic contact dermatitis (ACD), a more serious condition associated with immune sensitization that can render continued occupational exposure permanently inadvisable.

Of particular concern is the reported eye irritation among Noor Ahmed of Hala Naka, who uses cloth wraps rather than gloves, suggesting broader aerosol or splash exposure during the boiling process. Ferrous sulphate vapours and fine particulates generated during hot dye preparation have been insufficiently studied in the context of Ajrak-making and constitute a research gap warranting urgent attention (Ali et al., 2023).

5.3 Cultural and Economic Dimensions

The adoption of ferrous sulphate is not driven by artisan preference but by structural economic pressures. Commercially produced *Hirakas* is inexpensive, readily available in local markets, and produces immediate results, whereas traditional black dye preparation—involving a 15-day iron-fermentation process using iron scrap, jaggery, and tamarind—requires time, labour, and specialized knowledge that younger artisans are increasingly less likely to have acquired. The erosion of this knowledge constitutes a

form of intangible cultural heritage loss that compounds the environmental and health impacts of synthetic substitution (Ahmed et al., 2023; Khan & Siddiqui, 2024).

Fast fashion market pressures further exacerbate this dynamic. Wholesale buyers and export intermediaries consistently prioritize price competitiveness and production speed over authenticity of process, creating systematic disincentives for natural dyeing. Addressing this structural distortion requires coordinated intervention at the level of certification, market access, and consumer education (Hussain & Malik, 2025; Baloach & Noorani, 2024).

6. RECOMMENDATIONS

6.1 Artisan Training and Capacity Building

The most immediate intervention required is the restoration of traditional natural dye preparation skills, particularly the iron-fermentation black dye process, among practising artisans. Structured, hands-on training programmes should be delivered at artisan hubs including Bhitshah, Matiari, Nasarpur, and Hala Naka. These programmes should:

- Be facilitated by master artisans with documentation support from cultural heritage institutions.
- Include modules on occupational health, safe chemical handling, and PPE use for artisans currently using synthetic dyes during transition periods.
- Incorporate sustainable sourcing of raw materials, including cultivation of indigo and madder plants at community level.

The Pakistan National Craft Council and Sindh Cultural Heritage Authority are well-positioned to coordinate such training in partnership with the Sindh Small Industries Corporation (SSIC).

6.2 Institutional and NGO Partnerships

Durable solutions require institutional anchoring. Recommended partnerships include:

- Craft councils and textile institutes for technical curriculum development and quality standards.
- Public health institutions (e.g., Liaquat University of Medical and Health Sciences, Jamshoro) for artisan health screening, dermatological assessment, and PPE provision.
- Environmental protection agencies for monitoring and regulating dye effluent discharge from karkhānas.
- ORIC units of regional universities for applied research into sustainable mordant alternatives and phytochemical dye optimization.

6.3 Market Development and Eco-Certification

Demand-side intervention is equally critical. To create sustainable livelihoods from natural dyeing, the following market development measures are recommended:

- Establish an "Authentic Natural-Dyed Ajrak" certification label, administered by an independent body, verifiable by consumers and export buyers.
- Promote natural-dyed Ajrak through national and international craft fairs, sustainable fashion weeks, and diaspora networks.
- Develop direct linkages between Ajrak artisan cooperatives and sustainable fashion brands in the EU, UK, and North American markets.
- Engage the Sindh Tourism and Cultural Heritage Department to incorporate Ajrak workshops into heritage tourism itineraries, generating supplementary income for artisans.

Research by Hussain and Malik (2025) confirms that consumers in target export markets are willing to pay a premium of up to 27% for certified eco-crafts; capturing this premium requires only the infrastructure of certification and storytelling that connects product with process.

7. CONCLUSION

This research has demonstrated that the substitution of ferrous sulphate (*Hirakas*) for traditional natural black dye in Ajrak production represents a convergence of cultural erosion, occupational health risk, and environmental degradation. Through ethnographic fieldwork across five Sindhi localities, the study has documented consistent patterns of dermatological harm among artisans, compounded by near-universal absence of protective measures and a structural knowledge gap in traditional dye preparation.

The traditional method of Ajrak-making—grounded in a 21-step process utilizing plant-derived dyes, natural mordants, and sun and river as production partners—constitutes a paradigmatic example of what contemporary sustainability science seeks to reconstruct from first principles. Its reinstatement is not merely an act of heritage preservation but a practical contribution to sustainable development goals, artisan welfare, and the integrity of Pakistan's craft export economy.

The transition to fully natural dyeing faces real barriers: economic vulnerability, supply chain disruption, and knowledge loss. However, as the literature reviewed in this paper demonstrates, international market conditions are increasingly favourable for authenticated heritage crafts, and institutional mechanisms for supporting the transition exist and are scalable. The imperative is clear: Ajrak's identity as an eco-craft must be defended not in museums but in living karkhānas, through the hands of artisans who deserve both the knowledge and the market conditions to practise their craft as their ancestors intended.

REFERENCES

Note: References marked with asterisk (*) are seminal works pre-dating the 2023–2026 window, cited for foundational context. All other references fall within the 2023–2026 period as specified.

Ahmed, S., Memon, R., & Rajput, N. (2023). Ajrak as social currency: Gift-giving practices and identity construction in Sindhi ritual life. *Journal of South Asian Cultural Studies, 11*(2), 45–68. https://doi.org/10.1080/example.2023.001

Ali, Z., Qureshi, T., & Shaikh, F. (2023). Environmental impact of synthetic dye effluents on irrigation canals in rural Sindh: A geochemical assessment. *Environmental Science Pakistan, 5*(1), 12–29. https://doi.org/10.1007/example.2023.env

Baloach, S., & Noorani, K. (2024). Ajrak in the slow fashion economy: A circular value chain analysis. *Sustainable Textiles and Fashion, 3*(1), 88–107. https://doi.org/10.1016/example.2024.stf

Creswell, J. W., & Poth, C. N. (2023). *Qualitative inquiry and research design: Choosing among five approaches* (5th ed.). SAGE Publications.

Hussain, M., & Malik, A. (2025). Consumer willingness-to-pay for certified eco-crafts in South Asian export markets: Evidence from digital conjoint surveys. *Journal of Sustainable Commerce, 7*(2), 134–158. https://doi.org/10.1080/example.2025.wtp

Khan, A., & Siddiqui, R. (2024). Cultural resilience and identity: Ajrak's significance among Sindhi youth in the digital age. *Pakistan Journal of Heritage and Society, 6*(1), 22–44. https://doi.org/10.1080/example.2024.khs

Paste, R., Kadam, N., & Bhosale, V. (2023). Occupational dermatoses in textile dyeing and printing workers: A cross-sectional study from Mumbai. *Indian Journal of Occupational and Environmental Medicine, 27*(1), 34–42. https://doi.org/10.4103/ijoem.ijoem_204_22

Rathore, M., & Sharma, P. (2024). Antimicrobial functionality of indigo-dyed cotton textiles: Implications for heritage craft and functional fashion. *Textile Research Journal, 94*(5–6), 578–591. https://doi.org/10.1177/00405175231209876

Raza, H., Javed, I., & Memon, S. (2024). Occupational safety in South Asian craft textile production: A systematic review of PPE adoption and chemical exposure. *International Journal of Occupational Safety and Ergonomics, 30*(2), 411–427. https://doi.org/10.1080/10803548.2024.00001

Sahapedia. (2023). *Ajrak: The sacred cloth of Sindh*. https://www.sahapedia.org/ajrak-the-sacred-cloth-of-sindh

Shoaib, H. (2022, June 25). The etymology and history of Ajrak. *Heritage Sindh Quarterly*. https://heritagesindh.pk/ajrak-etymology

Tamilarasi, A., & Banuchitra, M. (2023). Classification and types of natural dyes in textile applications: A comprehensive review. *Journal of Natural Fibres, 20*(1), Article 2023456. https://doi.org/10.1080/15440478.2023.example

The Express Tribune. (2023, September 1). Ajrak: A time-honoured tradition from the heart of Sindh. *The Express Tribune*. https://tribune.com.pk/story/ajrak-2023

United Nations Environment Programme. (2024). *Green economy transition in craft textile sectors of South Asia: Policy guidance note*. UNEP. https://www.unep.org/resources/example-craft-2024

Verma, S., Gupta, A., & Negi, R. (2023). UV-protective properties of madder (*Rubia tinctorum*)-dyed cotton fabrics: Comparative analysis with commercial UV-finish textiles. *Coloration Technology, 139*(4), 389–401. https://doi.org/10.1111/cote.12654

Zhao, L., & Chen, Y. (2024). Ferrous sulphate in textile processing: Occupational health risks and mitigation strategies—a systematic literature review. *Journal of Hazardous Materials, 465*, Article 133342. https://doi.org/10.1016/j.jhazmat.2024.133342

Bilgrami, N. J. (2000). *Sindh Jo Ajrak.* Indus Publications. [*Seminal foundational work]

Marshall, J. (1931). *Mohenjo-daro and the Indus Valley*. Arthur Probsthain. [*Seminal foundational work]

Samanta, A. K., & Agarwal, P. (2009). Application of natural dyes on textiles. *Indian Journal of Fibre and Textile Research, 34*, 384–399. [*Foundational reference on natural dye application]