

Palm Leaf Veneer Sheets as a Sustainable Substitute Material for Interior Applications

Adithya Patel, Dr. Nischay N

Professor, Professor

Department of Interior Design, JD School of Design, Bengaluru, Karnataka, India.,

Associate Head, Department of Interior Design, JD School of Design, Bengaluru, Karnataka, India.

nischay.n@jdinstitute.edu.in

Abstract—Palm leaf veneer sheets are an emerging interior material created from naturally shed palm leaves—an agricultural waste often burned and left unutilized. This research explores the feasibility, sustainability value, functional behaviour, and user acceptance of palm leaf veneer sheets as an alternative to traditional wood veneers used in interior surfacing. A mixed-methods approach was followed, including literature review, material analysis, and a 54-respondent user survey. Findings indicate high user preference for natural-looking and environmentally responsible materials, with 61.1% willing to adopt natural-waste-based materials for walls, furniture, and decorative elements. The research demonstrates that palm leaf veneer sheets offer significant environmental benefits, aesthetic warmth, curved-surface flexibility, and VOC-free indoor performance. The study concludes that palm-leaf-based veneer has strong potential for sustainable interior applications and can reduce dependence on conventional timber veneers while addressing ecological and design needs.

Index Terms—Palm Leaf Veneer, Sustainable interior materials, Natural-waste surfaces, Eco-friendly design, Biodegradable veneers, Interior innovation.

I. Introduction

Interior surfaces form the most visible and tactile component of built environments. Conventional materials like plywood and wood veneers are widely used because of their familiarity and availability but also contribute significantly to deforestation, chemical emissions, and carbon footprint. Meanwhile, palm trees naturally shed large quantities of leaves, which are burned as waste, contributing to air pollution.

Palm Leaf Veneer Sheets (PLVS) are a sustainable alternative created by converting fallen leaves into thin, flexible sheets suitable for interior surfacing. These veneers are renewable, biodegradable, VOC-free, and aesthetically natural, aligning with global interior trends favoring earthy textures and eco-conscious surfaces. This research investigates how PLVS can be used as a substitutable interior material for wall panels, furniture surfaces, partitions, and decorative elements. The study also examines user perception, material performance, and the potential of palm leaf veneers to enter mainstream interior design applications.

II. LITERATURE REVIEW

1) Palm Leaf Veneers

Research on natural-waste-derived materials shows increasing interest in sustainable surfacing. Studies (Kumar et al., 2022; Rowell, 2012) emphasize biodegradable veneers and renewable fiber composites as viable alternatives to timber-based surfacing.

Purpose of the Study:	To understand the mechanical properties, sustainability features, finishing behavior, and possible applications of natural-waste veneers.
Method Used:	Literature analysis of eco-friendly veneer production, adhesive compatibility, and coating performance.
Key Findings:	<ol style="list-style-type: none"> 1 Palm leaves are naturally shed → no need for tree cutting. 2 Veneer thickness 0.8–2 mm suitable for interior application. 3 PU coating significantly improves moisture resistance and durability. 4 Flexible enough for curved surfaces. 5 Zero VOC emissions → safe for indoor environments.
Limitations & Gaps:	<ul style="list-style-type: none"> • Limited commercial-scale data on durability. • Few studies focus on palm leaf veneers in modern interiors. • Lack of structured user-acceptance studies.
Relevance:	<ul style="list-style-type: none"> • Forms the scientific foundation for evaluating palm leaf veneer application in interior design. • The Study of Veneer Machine from Oil Palm Stem – Dangwilailux et al., 2019

RESEARCH PAPER 1-

Author & Year	Purpose of the Study	Method Used	Key Findings	Limitations / Gaps
P. Dangwilailux, W. Kalasee & V. Akvanich (2019)	To design and evaluate an oil palm stem veneer peeling machine for producing thin veneer sheets for use in plywood manufacturing.	Experimental machine development using 28-year-old oil palm stems (8m length, 400–500mm diameter). Veneer peeling tested under variations of roller speed (100, 120, 140 rpm), feed rate (0.17, 0.29, 0.59 m/min), and moisture content (55%, 65%, 75%). Mechanical testing included tensile strength using ASTM standards.	Machine successfully produced continuous veneer sheets of 1–3 mm thickness and 2400 mm length. Best operation at 120 rpm roller speed & 0.29 m/min feed rate, producing strong veneer without breakage. Optimum moisture at 65%, highest tensile strength recorded 1.24 MPa.	Study focuses only on machine performance; does not evaluate interior design usability, surface finish, bonding techniques, durability under indoor conditions, commercial adoption or designer/user perception. No exploration of aesthetic qualities or market integration, limiting real-world application research.

Summary : This research advances engineering and production feasibility of oil palm veneer but leaves open opportunities for studying interior application performance, finishing processes, and design-related acceptance, which aligns directly with your research direction.

RESEARCH PAPER 2-

Author & Year	Purpose of the Study	Method Used	Key Findings	Limitations / Gaps
Hasmawi Khalid, Zakiah Ahmad, Paridah Md. Tahir, Jamaludin Kasim — 2014	To investigate the effect of treating oil palm stem (OPS) veneers with phenol-formaldehyde resin on the dimensional stability (water absorption, thickness swelling) and mechanical properties (compression, panel shear) of OPS plywood.	Four types of plywood panels: Type A & B = commercial OPS plywood (with tropical hardwood face/back), Type C = tropical plywood, Type D = 100% OPS plywood using veneers treated with phenol-formaldehyde. Tests: water absorption, thickness swelling (EN 317), compression and panel shear strength.	Treated OPS plywood (Type D) showed lowest water absorption and highest compression and panel shear strength. Type B exhibited lowest thickness swelling among commercial types.	Study focuses only on plywood with treatment; does not explore long-term durability, surface finish, furniture/interior application, full range of mechanical tests (e.g., bending, impact), or user/market acceptance.

Effect of Veneer Treatment with Phenol Formaldehyde on Dimensional Stability and Mechanical Properties of Oil Palm Stem (OPS) Plywood

Summary: The study investigates the effect of treating oil palm stem (OPS) veneers with phenol-formaldehyde resin to improve dimensional stability and mechanical performance of OPS plywood. Treated veneers produced plywood with lower water absorption, reduced thickness swelling, and significantly higher compression and shear strength compared to untreated commercial OPS panels. The results show that chemical treatment enhances the usability of OPS as an engineered wood material. However, the research does not explore real interior applications, long-term durability, or aesthetic/market acceptance considerations.

RESEARCH PAPER 3-

Author & Year	Purpose of the Study	Method Used	Key Findings	Limitations / Gaps

Abdul Hamid Saleh, Izran Kamal, Noor Azrieda Abdul Rashid, H.P.S. Abdul Khalil, Ahmad Shakri Mat Seman, Siti Mahmud — 2011	To evaluate the suitability of oil palm trunk veneer for use in moulded laminated veneer oil palm (MLVOP) furniture components and determine optimal pressing and veneer-arrangement parameters.	Veneers produced from oil palm trunks, segregated into “superior (S)” and “inferior (I)” qualities. Five-layer moulded composites made with different veneer arrangements (100% S; alternate S/I; surface S & core I). Hot-pressed at pressures of 1500, 2000, 2500 psi; adhesives used: urea formaldehyde (UF) and phenol formaldehyde (PF).	Samples bonded with UF exhibited higher modulus of rupture (MOR) and modulus of elasticity (MOE) compared to PF-bonded samples across most veneer arrangements and pressures. Best performance generally came from boards made with 100% S veneers and higher pressing pressures. The study concludes that oil palm trunk veneers can be used for furniture components albeit with optimization	The study is preliminary: it deals mainly with bending tests and basic veneer arrangements and pressing variables, but DOES NOT cover long-term durability, real furniture performance, finishing/surface quality, interior usability or market acceptance. Also, veneer segregation process and quality variability need further exploration.
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Preliminary Study of Moulded Laminated Veneer Oil Palm (MLVOP)

Summary: The study investigates the feasibility of using oil palm trunk veneers in moulded laminated veneer oil palm (MLVOP) components for furniture applications. Different veneer qualities, adhesive types, and pressing pressures were tested to evaluate bending strength (MOR/MOE). The results showed that UF-bonded veneers and higher press pressures produced stronger panels, confirming the potential of oil palm veneer as an engineered wood alternative. However, the research remains preliminary and lacks evaluation of long-term durability, finishing, and real interior application performance.

2) Sustainable & Natural-Waste Materials in Interiors

Sustainable materials are widely discussed in relation to circular economy and eco-friendly design approaches. Studies highlight user interest in natural finishes, but adoption gaps exist due to limited awareness.

- Users associate natural materials with “healthy,” “natural,” and “durable.”
- Market shift toward renewable materials is rising globally.
- Natural finishes reduce indoor toxicity and environmental load.

Supports the view that palm leaf veneers align with modern interior sustainability requirements.

3) Material Alternatives to Wood Veneers

Existing research reveals growing demand for renewable veneer alternatives.

- Natural-fiber sheets and eco-veneers are gaining traction.
- Key challenges include cost perception and durability doubts.

Minimal research exists specifically on palm leaf veneers for interiors.

III. **AIM, OBJECTIVES & SCOPE**

1) **Material Alternatives to Wood Veneers**

To explore and evaluate Palm Leaf Veneer Sheets as a sustainable alternative to conventional wood veneers in interior applications and assess user acceptance toward this material

2) **OBJECTIVES (SMART Format)**

- To analyze the physical, functional, and aesthetic characteristics of palm leaf veneer sheets.
- To evaluate possible interior applications such as wall panels, furniture faces, and decorative surfaces.
- To assess user perception and adoption preferences through a structured survey of 54 respondents.
- To study sustainability benefits including waste reduction, VOC-free interiors, and tree-cutting reduction.

3) **SCOPE**

- Focuses on interior surfaces (non-structural use).
- Covers palm leaf-based veneer sheets only.
- Survey conducted among design-aware respondents.
- Coating and installation compatibility studied only for interior settings.

4) **LIMITATIONS**

- Durability analysis is short-term; no long-term aging tests.
- Market availability varies regionally.
- Limited sample size for survey.

IV. **RESEARCH METHODOLOGY**

1) **Literature Review**

Review of natural-waste materials, eco-veneers, coating performance, interior sustainability, and user behavior studies.

2) **Material Exploration**

- Study of veneer thickness
- Texture, grain, and color analysis
- Flexibility and substrate compatibility (MDF, plywood)
- PU coating test for waterproofing

3) **User Perception Survey**

A 54-response structured survey was used to understand awareness, preferences, material associations, and willingness to adopt palm leaf veneer.

4) **Visual Assessment**

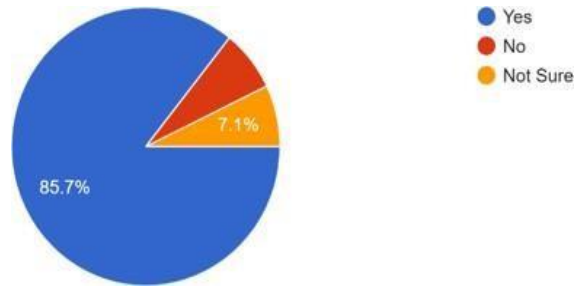
Mock panels and sample sheets were visually analyzed for aesthetic appeal.

V. **SURVEY ANALYSIS**

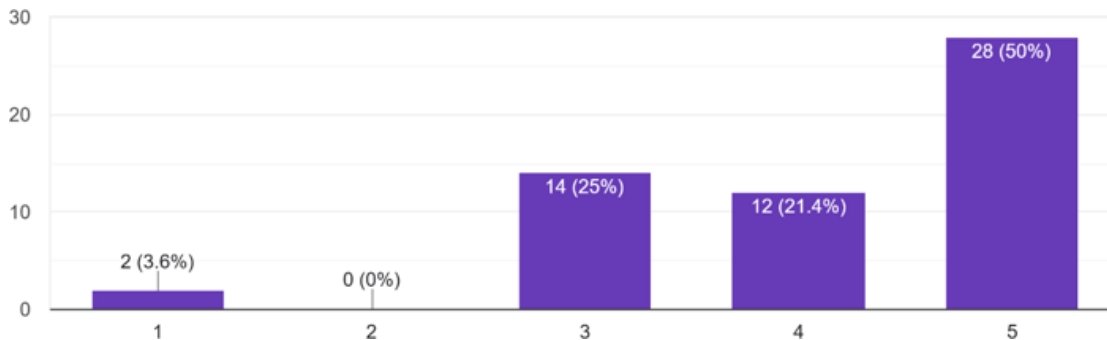
- 1) Before this, had you heard about sustainable or eco-friendly materials used in interiors?

Output: 85.2% said No, 7.4% Yes, 7.4% Not Sure

Justification: Majority lack awareness → indicates poor exposure and marketing of eco materials. This forms the core problem: knowledge gap.



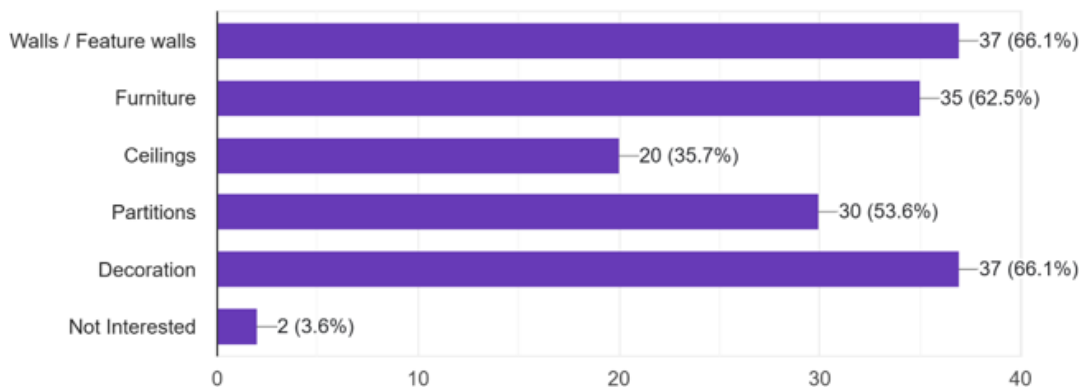
2) How important is sustainability for you while designing or renovating a space?



Output: 51.9% rated 5 (**very important**), 22.2% rated 4, 22.2% rated 3, 3.7% rated 1–2

Justification: Users personally value sustainability but don't know material options → shows intent exists but implementation is missing due to uncertainty.

3) Where would you prefer using natural / eco-friendly materials in interiors?



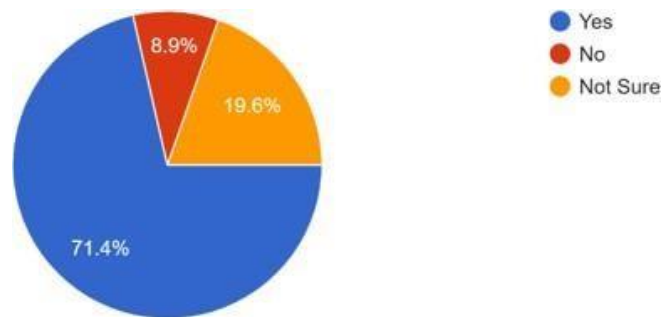
Most selected: Walls (68.5%), Decoration (64.8%), Furniture (63%), Partitions (53.7%), Ceilings (37%), Not Interested (3.7%)

Justification: Users trust natural veneers more for **visible & aesthetic surfaces**, not structural → aligns with palm-leaf veneer strengths (flexible, decorative, feature surfaces).

4) Do you believe using eco-friendly materials can reduce environmental problems (like waste burning or cutting trees)?

Output: 72.2% Yes, 18.5% Not Sure, 9.3% No

Justification: Most users logically understand sustainability benefits → awareness campaigns will easily convert unsure group.



VI. RESULTS & DISCUSSION

Palm leaf veneer sheets demonstrate strong potential in interiors:

- Aesthetic Value: Natural grain, earthy tone, unique textures.
- Flexibility: Ideal for curves and seamless paneling.
- Sustainability: Zero tree cutting, uses fallen leaves, biodegradable.
- Indoor Safety: VOC-free surface finish.

Survey results show high interest in natural-waste materials and strong willingness to apply them across interior surfaces.

However, durability concerns, cost perception, and lack of awareness remain barriers. PU coating helps address functional concerns, making PLVS comparable to traditional veneers

VII. HYPOTHESIS

Declarative Hypothesis (Directional)

Using palm leaf veneer sheets in interior surfacing is expected to significantly enhance sustainability value, user acceptance, and aesthetic appeal compared to traditional wood veneers. This hypothesis assumes that palm leaf veneers, being derived from renewable natural waste materials, offer a lower environmental impact and a unique visual texture that can attract users seeking eco-friendly yet visually appealing design solutions. It predicts that the distinct material characteristics of palm leaf veneer—such as its organic patterns, lightweight nature, and sustainable sourcing—will lead to higher overall preference and perceived design value.

Null Hypothesis (H_0)

There is no significant difference between palm leaf veneer sheets and traditional wood veneers in terms of sustainability, aesthetic appeal, or user preference. This hypothesis assumes that users evaluate both materials similarly, and that choosing palm leaf veneer does not result in any measurable improvement in environmental performance, visual attractiveness, or acceptance within interior applications. It suggests that any observed differences between the two materials are due to chance rather than meaningful variation in their qualities or performance.

Hypothesis in Question Form

Does using Palm Leaf Veneer Sheets improve sustainability, aesthetic quality, durability perception, and user preference in interior spaces compared to conventional veneers?

VIII. CONCLUSION

Palm Leaf Veneer Sheets are a viable, innovative, and sustainable alternative for interior surfacing. Their flexibility, biodegradable nature, visual warmth, and VOC-free composition make them suitable for modern eco-conscious interiors. Survey findings reinforce high user openness to natural-waste materials, especially for feature walls and decorative elements. With improved awareness, coating enhancements, and commercial integration, PLVS can significantly reduce dependency on timber and promote sustainable interior design practices.

References

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