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Development of Eco-Friendly Cork Board

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Abstract: Environmental sustainability drives the search for renewable, eco-friendly alternatives to conventional products. Cork boards are widely used, yet commercial options are often neither sustainable nor cost-effective. This study addresses this by utilizing locally available organic materials—specifically dried Indian Almond tree (*Terminalia catappa*) leaves, which are abundant and typically treated as waste. By combining crushed leaves with wood adhesive, this research develops an eco-friendly cork board. It evaluates different material ratios to identify the optimal formulation that meets desired quality, sensory characteristics, and acceptability standards, offering a low-cost, sustainable alternative while promoting waste reduction. This study developed a sustainable cork board using crushed, dried *Terminalia catappa* leaves mixed with wood adhesive. It aimed to assess sensory characteristics, acceptability, and differences among three treatments: A (100g:150ml), B (200g:180ml), and C (300g:200ml). Using an experimental-developmental design under CRD, 30 evaluators rated the products via a 5-Point Likert scale. Data were analyzed using mean and ANOVA at 0.05 significance level. Results showed all treatments were "Very Acceptable"; Treatment C ranked best, rated "Very Appealing, Very Smooth, Very Compact, and Moderately Thin". While appearance and compactness were similar across groups, texture, thickness, quality, and overall performance differed significantly, with Treatment C outperforming others. The study concludes that Indian Almond leaves are a renewable, low-cost, and eco-friendly material suitable for cork board production, helping reduce waste. Future research is recommended to explore other organic additives and improved processing methods to enhance durability and commercial value.

Keywords: Eco-friendly, cork boards, Indian almond tree, Terminalia catappa, sensory characteristics, acceptability, sustainability materials.

I. INTRODUCTION

Background of the Study

Growing environmental concerns such as climate change, resource depletion, and waste pollution have driven a global shift toward sustainable alternatives to conventional products. Traditional display and bulletin boards often rely on synthetic, non-biodegradable materials that contribute to long-term ecological harm. In response, industries and institutions are increasingly prioritizing renewable, locally sourced, and eco-friendly materials to reduce environmental footprints and support responsible production. Cork, known for its biodegradability and regenerative properties, serves as a model for such sustainable resources, yet there remains a need for more accessible and cost-effective substitutes that can be derived from abundant organic waste.

In the Philippines, solid waste management is a critical issue, with organic materials comprising over half of the country's annual waste output. Aligned with national laws such as Republic Act 9003 and Republic Act 11898, government agencies promote the utilization of agricultural and natural residues as raw materials to minimize pollution and dependence on imported goods. This policy direction encourages educational institutions to develop green innovations and replace conventional supplies with environment-friendly alternatives. There is a rising focus on converting plant residues into functional products, supporting local industries while addressing the country's high vulnerability to climate change and the urgent need for waste reduction.

Locally, in Capiz and the wider Western Visayas region, fallen leaves from Talisay (*Terminalia catappa*) or Indian Almond trees are abundant yet largely treated as waste, often burned or left to decompose improperly. These leaves represent an untapped resource that can be processed into useful items, helping reduce accumulation and pollution. Commercial cork boards used in schools and offices are typically expensive and non-biodegradable, creating a demand for affordable, locally produced, and sustainable options. Developing cork boards from dried Talisay leaves offers a practical solution by transforming natural debris into functional materials, addressing local waste concerns, and providing a low-cost, eco-friendly alternative suitable for educational and professional use.

Objectives of the Study

The main objective of this study aimed to develop eco-friendly cork board.

Specifically, it sought to:

1. describe the sensory characteristics of eco-friendly cork board in terms of appearance, texture, compactness, thickness.

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2. find out if there is a significant difference of eco-friendly cork board among three (3) treatments in terms of appearance, texture, compactness, thickness.

determine the acceptability of the eco-friendly cork board in terms of appearance, texture, compactness, thickness.

II. METHODOLOGY

This study employed a developmental-experimental research design, focusing on the creation and evaluation of cork boards made from dried and crushed leaves of the Talisay tree (*Terminalia catappa*). This design follows a scientific approach involving controlled procedures, variable manipulation, and randomization to establish relationships between variables and test the study's hypothesis. It allows for precise measurement and comparison of characteristics, determining whether the results support or reject the proposed assumptions.

Experimental research was used to assess the product's sensory attributes—specifically appearance, texture, compactness, thickness, and quality of the finished product. Complementing this, developmental research, as defined by Marmorstein (2022), guided the process from concept to actual production. It involves creating new products or improving existing ones, and in this study, it focused on determining the product's overall acceptability and identifying the optimal formulation.

Three (3) treatments with varying proportions of dried crushed leaves and wood adhesive were prepared and tested. This setup aimed to identify the ideal quantity of raw materials required to produce a high-quality cork board. The findings from this study serve as a basis for further improvement, with the potential for the product to be refined and made available for commercial use.

Locale and Respondents of the study

The study was conducted at Capiz State University – Main Campus, Roxas City, Capiz, where the product development, preparation, and evaluation activities were carried out. The respondents were composed of thirty (30) evaluators selected based on their knowledge, expertise, and relevance to the study: ten (10) Drafting Professors from the university, ten (10) Arts and Crafts Experts, and ten (10) students. These evaluators were tasked to assess the three formulated treatments of the eco-friendly cork board. Their feedback served as the primary data to determine the sensory characteristics and overall acceptability of the product.

Research Instrument

The primary tool used in this study was a sensory evaluation sheet, specifically developed to assess key characteristics of the eco-friendly cork board: appearance, texture, compactness, and thickness. It utilized a Five-Point Likert Scale, which allowed evaluators to assign a numerical value to their assessment, enabling quantitative measurement of the product's qualities. To ensure the instrument's validity and reliability, it underwent validation by a panel of experts consisting of instructors, students, and arts specialists. Their feedback and suggestions were integrated to refine the tool, ensuring it was clear, relevant, and capable of accurately measuring the product's acceptability.

Data Gathering Procedures

Data collection began by providing the validated evaluation sheets and clear assessment guidelines to the selected evaluators. They were tasked to rate the identified product attributes using the provided Five-Point Likert Scale. After completing the assessment of all three treatments, the evaluation sheets were retrieved, compiled, and systematically tallied. The gathered data were then subjected to statistical analysis to determine the mean ratings for each characteristic and the general acceptability of the product, providing the necessary basis for interpreting the study's results.

III. RESULTS AND DISCUSSION

Sensory Characteristics of the Eco-Friendly Cork Board from Indian Almond Tree in terms of Appearance

All treatments were rated "Very Appealing": Treatment A (4.30), Treatment B (4.33), and Treatment C (4.57) — the highest rating. Treatment C showed the best visual quality, with a smoother, more compact, uniform, and flawless finish due to its optimal leaf-to-adhesive ratio. This aligns with previous studies confirming that higher natural material proportions and balanced ratios improve surface uniformity, color consistency, and aesthetic quality in eco-friendly boards. Findings validate that optimizing raw material composition significantly enhances the product's visual attributes and overall acceptability.

Sensory Characteristics of the Eco-Friendly Cork Board from Indian Almond Tree in terms of Texture

Treatment A obtained a mean of 3.40 (*Moderately Smooth*), showing a fairly even surface with minor irregularities. Treatment B scored 3.90 (*Smooth*), with minimal roughness and a texture comparable to commercial standards. Treatment C had the highest rating at 4.47 (*Very Smooth*), exhibiting a dense, well-bonded, and exceptionally

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refined surface with almost no imperfections. This superior quality resulted from the optimal ratio of leaves and adhesive, producing a finish similar or even better than commercial products. Consistent with related studies, the findings confirm that balanced formulation and proper material blending significantly enhance smoothness and tactile quality.

Sensory Characteristics of the Eco-Friendly Cork Board from Indian Almond Tree in terms of Compactness

All treatments were rated *Extremely Compact*. Treatment A and Treatment B both scored 4.57, showing tightly packed, well-bonded, and structurally sound boards comparable to commercial standards. Treatment C obtained the highest mean of 4.77, achieving the densest, most solid, and flawlessly consolidated structure with maximum rigidity and durability. These findings align with previous studies, confirming that optimized material ratios and proper binding significantly enhance compactness, structural stability, and overall quality.

Sensory Characteristics of the Eco-Friendly Cork Board from Indian Almond Tree in terms of Thickness

Treatment A obtained a mean of 2.53 (*Slightly Thick*), resulting in a slim profile with limited pin-holding capacity. Treatment B scored 3.00 (*Moderately Thick*), showing a slightly fuller but still relatively thin structure compared to commercial standards. Treatment C recorded the highest rating at 4.80 (*Extremely Thick*), achieving an ideal, substantial thickness comparable to market products, ensuring better durability and functionality. These findings align with previous studies, confirming that higher material proportion and optimized formulation directly improve thickness and physical quality.

Difference in the sensory characteristics of the Eco-friendly Cork Board among three treatments in terms of appearance, texture, compactness, and thickness

ANOVA results showed no significant differences in appearance (p=0.339) and compactness (p=0.319) across the three treatments, meaning these traits stayed consistent. In contrast, texture (p=0.000), thickness (p=0.000), and overall product quality (p=0.000) varied significantly, strongly affected by material combinations and processing methods. These findings align with related studies noting stable visual and structural consistency when core parameters are unchanged, while surface and dimensional properties shift with treatment. Consequently, the study's hypothesis is accepted for appearance and compactness, but rejected for texture and thickness.

General Acceptability of the Eco-friendly Cork Board in Terms of Appearance, Texture, Compactness and Thickness

The general acceptability of the eco-friendly cork board in terms of appearance, texture, compactness, and thickness shows an overall positive evaluation from the respondents. In terms of appearance, the cork board obtained a mean score of 4.80, verbally interpreted as very acceptable. This indicates that the product has a highly pleasing visual quality, suggesting that it is well-designed and attractive for its intended use. For texture, the mean score of 4.54 is also interpreted as very acceptable. This implies that the surface quality of the cork board is smooth and satisfactory, contributing positively to user handling and overall experience.

Regarding compactness, the product achieved a mean score of 4.78, likewise interpreted as very acceptable. This suggests that the cork board is well-pressed and structurally firm, indicating strong material bonding and good durability, which are essential for its functionality.

In contrast, thickness obtained a mean score of 3.54, interpreted as acceptable. This indicates that while the thickness is still within an acceptable range, it is comparatively lower than the other factors and may require improvement to enhance its sturdiness and performance depending on its intended application.

Overall, the findings imply that the eco-friendly cork board is generally very acceptable in terms of appearance, texture, and compactness, demonstrating strong potential as a sustainable material product. However, attention to improving thickness could further enhance its structural quality and overall effectiveness, making it more suitable for broader practical use.

IV. CONCLUSIONS

The study successfully developed an eco-friendly cork board using dried leaves of the Indian Almond Tree *(Talisay)* with wood glue as a binding agent, formulated across three different treatments. In terms of general sensory characteristics, the product obtained high ratings for appearance indicated a "*Very Appealing"* and has a mean of 4.40, for the compactness evaluated as "*Very Compact" with a mean score of* 4.64, indicating strong aesthetic quality and excellent structural integrity. Texture was rated "*Moderately Smooth* with a mean score of 3.57, while thickness was rated "*Moderately Thick"* has a mean of 2.78, showing that these attributes still require improvement to meet optimal standards.

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When compared across treatments, Treatment C (300 g dried leaves + 200 ml wood glue) consistently recorded the highest mean scores across all parameters: *Very Appealing* in appearance, *Moderately Smooth* in texture, *Very Compact* in and Moderately thick rating. Statistical analysis revealed no significant difference among the three treatments in terms of appearance and compactness, meaning all formulations performed equally well in these aspects. However, significant differences existed in texture and thickness, confirming that varying the amount of raw materials directly influenced these properties with higher proportions yielding better results.

In terms of acceptability, the developed eco-friendly cork board was generally rated *Very Acceptable* in appearance with a mean of 4.80, texture has a mean of 4.54, and compactness has a mean score of 4.78. Thickness was rated only *Moderately Acceptable* and has a mean of 3.54, though Treatment C improved this to *Very Acceptable*. This confirms that the product meets quality and user standards, with Treatment C emerging as the most preferred and market-ready formulation due to its superior overall quality.

V. RECOMMENDATION

Based on the results and conclusions of this study, the following recommendations are proposed to further improve the quality, marketability, and consumer acceptability of the eco-friendly cork board produced from Indian almond leaves.

While the physical properties of the developed board were found to be satisfactory, future research may explore alternative treatments or modifications to further enhance its surface quality and longevity. For instance, incorporating natural additives or optimizing production methods could yield a stronger and more visually appealing product, making it more competitive in various applications. To further improve sensory attributes such as appearance, texture, density, and thickness, future studies may consider blending Indian almond leaves with other types of dried foliage or flower petals. Optimizing the combination of these materials could balance the board's characteristics, resulting in a superior product with enhanced structural integrity and aesthetic value.

Although the product achieved high acceptability ratings, expanding the number of respondents in sensory evaluation is recommended. A larger sample size would provide more diverse feedback, helping to identify subtle aspects of appearance and texture that could influence consumer preference. Additionally, exploring advanced processing techniques may further improve the board's uniformity and smoothness, thereby increasing its commercial viability. Future investigations could also test different proportions of raw materials or integrate other organic waste materials. This approach may lead to the development of a more versatile product suitable for specialized uses, such as table or artistic materials. Furthermore, based on evaluators' feedback, it is suggested that the dimensions of the board be increased to accommodate a wider range of uses. This modification would enhance its practical functionality for both household and commercial purposes. Notably, the material showed significant potential for use in furniture design; hence, maximizing its properties could lead to innovative applications, such as the creation of durable and aesthetically pleasing tables.

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