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DEVELOPMENT OF ECO-FRIENDLY HANDCRAFTED HOME DECORATIVE PRODUCTS USING AGRO-WASTE FIBERS

[1]Dr.Ramya Kanagaraj, [2] Ms.Kokila K

[1] Assistant Professor [2] MSc Final Yaer

[1]Department of Apparel Fashion Design

[1]NIFT-TEA College of Knitwear Fashion, Tamilnadu, India

Abstract: The increasing demand for sustainable and eco-friendly products has promoted the utilization of agro-waste resources in textile and craft applications. This study focuses on the development of eco-friendly handcrafted home decorative products using aloe vera fiber, an underutilized natural fiber extracted from aloe vera leaves. The fiber was sourced and processed, followed by natural dyeing using agro-waste and plant-based dye sources, including onion outer peel, manjistha, indigo and wild turmeric.

Natural dyeing was carried out using the boiling method, and the effects of pre-mordanting techniques were studied. Eco-friendly mordants such as alum were used to improve dye absorption and colour fastness while ensuring environmental safety.

The dyed aloe vera fibers were developed into handcrafted home décor items through braiding and weaving techniques. Products developed included wall hangings, table mats, door hangings, eco-friendly artificial flowers, and photo frames. The finished products were evaluated for colour fastness to washing, and light, along with visual appearance and consumer acceptability. This study highlights the potential of aloe vera fiber and agro-waste dyes in producing value-added, biodegradable home décor products, supporting sustainable craftsmanship and waste utilization.

Keywords: *Agro-waste fibers, Natural dyes, Mordanting techniques, Eco-friendly home decor, Sustainable craftsmanship, Value-added products*

I. INTRODUCTION

Today, people worldwide are increasingly concerned with protecting the atmosphere and biodiversity by enhancing the sustainability and quality of eco-friendly products (Madhu et al., 2018). Owing to their bio-renewable nature and environmentally benign characteristics, natural fibers are being reconsidered as viable alternatives to synthetic and hazardous materials. In addition, the growing awareness of climate change, resource depletion, and environmental pollution has accelerated the demand for sustainable materials with lower carbon footprints and reduced ecological impact. Although natural fibers exhibit certain limitations, such as hydrophilicity and compatibility-related challenges, these drawbacks can be effectively mitigated through surface modification techniques and chemical treatments, thereby expanding their range of applications. Consequently, natural fibers have been successfully utilized in diverse fields, including composite materials, construction and engineering, textiles, biomedical applications, biopolymers, biosensors, and smart packaging (Vinod et al., 2018).

Fibers are defined as materials that are long, thin, continuous, and flexible, enabling the formation of elongated structures. Based on their origin, fibers are broadly classified into natural, semi-synthetic, and synthetic categories. Natural fibers are abundant, cost-effective, and offer several advantages over synthetic counterparts, including lower density, reduced energy requirements, renewability, biodegradability, absence of skin irritation, high strength-to-weight ratio, and favourable mechanical properties such

as strength and elastic modulus. Furthermore, natural fibers contribute to reduced greenhouse gas emissions and support sustainable agricultural practices by utilizing renewable resources. These characteristics highlight their potential as substitutes for glass, carbon, and other synthetic fibers. Therefore, natural fibers are widely employed in textiles, pulp and paper industries, accessories, biocomposites, and handicrafts (Suparno, 2020).

In recent years, the utilization of agro-waste fibers has emerged as a sustainable strategy for value addition and waste minimization in the textile and craft sectors (Rana and Sethi 2025). Agricultural residues, often discarded, burned, or underutilized, contribute significantly to environmental pollution, particularly air pollution and carbon emissions (Karuppuchamy et al., 2024). Converting these residues into value-added textile materials not only reduces waste but also promotes a circular economy approach. Agro-waste fibers such as banana fiber, pineapple leaf fiber, coconut coir, and aloe vera fiber possess promising physical and mechanical properties suitable for various applications (Oyedeji et al., 2024).

The present study focuses on the selection and utilization of agro-waste–derived natural fibers for developing sustainable handcrafted home décor items. Emphasis is placed on the application of natural dyeing techniques using plant- and agro-waste–based dye sources, along with eco-friendly mordants, to enhance colour fixation and functional performance. In addition to aesthetic appeal, natural dyes may also impart functional properties such as antimicrobial activity, UV protection, and antioxidant characteristics, thereby increasing the value of the final product.

By integrating selected fibers, natural dyes, and environmentally benign mordants, this study aims to demonstrate a sustainable product development approach that promotes environmental conservation, supports traditional craftsmanship, enhances rural livelihoods, and adds economic value to agro-waste resources. This approach aligns with global sustainability goals and encourages the adoption of eco-friendly alternatives in the textile and home décor industries

II . METHODOLOGY

2.1 Selection of Materials

The selection of raw materials for the present study was based on factors such as availability, sustainability, dyeing suitability, and end-use application. Aloe vera fiber was chosen as the primary raw material for the development of eco-friendly handcrafted home decorative products. The fiber was procured from Fiber Regain, Chennai, Tamil Nadu.

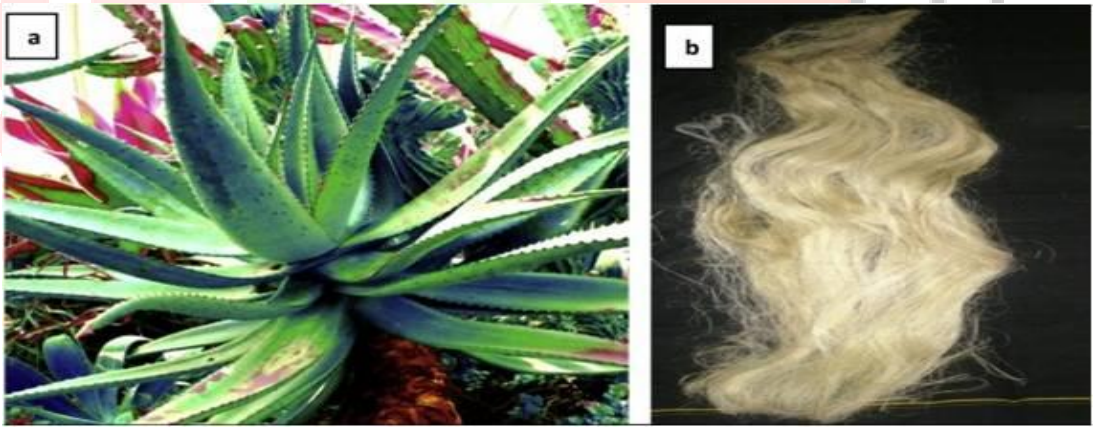

Figure 1(a) Aloe Vera plant (b) Aloe Vera Fiber

2.2 SCOURING PROCESS

In this process, impurities, dirt, oil, and other natural contaminants present in the raw fiber were removed. For the scouring process, 2 g of fiber was taken and treated with 1% salt (0.02 g) and 2% detergent (0.04 g). The treatment was carried out using a material-to-liquor ratio (MLR) of 1:20. The scouring process was conducted at a temperature of 60°C for a period of 1 hour. After the completion of the process, the fiber was thoroughly rinsed with clean water to remove impurities.

2.3 BLEACHING

Bleaching was carried out to enhance the whiteness of the fiber and to remove the natural colour present in the material. In this process, 2 g of fiber was treated with 0.6 ml of hydrogen peroxide in 18 ml of water. The treatment was carried out at a temperature of 60°C for 1 hour. After the bleaching process, the fiber was thoroughly rinsed with clean water to remove excess chemicals and then shade dried to a suitable moisture level for further processing.

Figure 2: Bleaching for aloe vera

2.3 MORDANTING

The mordanting process was carried out to improve dye fixation and colour fastness of the natural dyes on the fiber. Alum solution was used as the mordant. For the mordanting process, 2 g of fiber was treated with a solution containing 0.8 g of alum dissolved in 18 ml of water. The treatment was carried out at a temperature of 60°C for 30 minutes. After the completion of mordanting, the fiber was removed from the solution and prepared for the dyeing process. This treatment helps to improve the bonding between the fiber and the natural dyes, resulting in better dye absorption and colour fastness.

2.4 DYE EXTRACTION

2.4.1 Onion Outer Peel

Onion outer peel was selected as a natural source of yellow dye. It is an agricultural waste material that contains natural pigments capable of producing yellow, golden, and light brown shades on fibers. For dye extraction, 5 g of dried onion outer peel was taken and mixed with 120 ml of water. The mixture was heated and maintained at 60°C for 1 hour to extract the colouring pigments present in the onion peel. After extraction, the solution was filtered to remove solid residues, and the clear dye extract was collected for fiber dyeing.

Figure 3: Onion Outer Peel Extraction

2.4.2 Wild Turmeric

Wild turmeric was selected as a natural dye source to produce yellow shades on the fiber. For dye extraction, 5 g of dried wild turmeric powder was taken and mixed with 120 ml of water. The mixture was heated at 60°C for 1 hour to extract the colouring pigments. After extraction, the solution was filtered to remove solid particles, and the filtered dye extract was used for fiber dyeing.

Figure 4: Wild Turmeric Extraction

2.4.3 Manjistha

Manjistha was selected as a natural source of red dye. For dye extraction, 5 g of dried manjistha powder was taken and mixed with 120 ml of water. The mixture was heated at 60°C for 1 hour to extract the colouring pigments. After extraction, the solution was filtered to remove solid particles, and the dye extract was collected for fiber dyeing.

Figure 5: Manjistha Extraction

2.4.5 Indigo Powder

Indigo powder was selected as a natural source of blue dye and is one of the oldest natural dyes used in textile dyeing. For dye extraction, 5 g of indigo powder was taken and mixed with 120 ml of water. The mixture was heated at 60°C for 1 hour to extract the colouring pigments. After extraction, the solution was filtered to remove impurities, and the filtered dye extract was used for fiber dyeing.

Figure 6: Indigo powder Extraction

2.5 NATURAL DYEING OF ALOE VERA FIBER

Natural dyeing of aloe vera fiber was carried out using different plant-based dye sources, namely onion outer peel, wild turmeric, manjistha, and indigo powder. The dyeing process followed a uniform procedure for all selected dyes.

For each dyeing trial, 100 g of fiber was immersed in a dye bath consisting of 700 ml of respective natural dye extract and 900 ml of water. The dyeing was conducted at a controlled temperature of 60°C for 1 hour, with occasional stirring to ensure uniform dye penetration and even colour distribution.

After completion of the dyeing process, the fibers were removed from the dye bath, thoroughly washed with clean water to eliminate unfixed dye particles, and subsequently dried under shade.

The different natural dye sources imparted distinct shades to the aloe vera fiber. Onion outer peel produced yellow to light brown shades, wild turmeric yielded bright yellow shades, manjistha resulted in pink to reddish hues, and indigo powder developed blue colour shades.

Figure 7: (a) Onion peel dyeing (b) manjistha (c)wild turmeric (d) Indigo dye

2.6 DEVELOPMENT OF HOME DECORATIVE PRODUCTS

The naturally dyed aloe vera fibers were utilized to develop home decorative products using various craft techniques such as braiding, knotting, weaving, and wrapping.

Figure 8: Developed Home Decorative Products (a) photo frame (b) flower with pot (c) charismas tree (d) pen stand

IV. RESULTS AND DISCUSSION

4.1 COLOUR FASTNESS TO LIGHT (ISO 105-B02)

The colour fastness to light was evaluated according to the standard testing method ISO 105-B02. In this method, the dyed aloe vera fiber samples were exposed to artificial light using a xenon arc lamp under controlled conditions.

Table 1: Colour fastness to light

S.No	Fibers (Natural Dye Source)	Value Grade
1	Onion Outer Peel	4
2	Wild Turmeric	4

The colour fastness to light of naturally dyed aloe vera fibers was evaluated, and the results indicated a grade of 4 for both onion outer peel and wild turmeric dyes. This grade signifies good resistance to light, indicating that the dyed fibers can withstand exposure to light with minimal fading.

The satisfactory light fastness may be attributed to the effective bonding between the natural dye molecules and the fiber structure, possibly enhanced by the use of mordants during the dyeing process. Both onion peel and wild turmeric dyes demonstrated stable colour retention, making them suitable for applications in home decorative products that are exposed to light conditions.

Overall, the results confirm that natural dyes can provide acceptable light fastness properties on aloe vera fibers, supporting their use in sustainable and eco-friendly textile applications.

5. CONCLUSION

The present study focused on the development of eco-friendly home decorative products through handcrafting techniques using aloe vera fibers extracted from agricultural waste. The findings revealed that aloe vera fibers can be effectively extracted and processed for craft applications. Natural dyes such as onion skin, manjistha, wild turmeric, and indigo produced attractive and environmentally friendly shades on the fibers.

The dyed fibers were successfully utilized to design home decorative products using simple techniques like braiding, knotting, and weaving. The developed products exhibited good aesthetic appeal and were suitable for interior decoration purposes. This study clearly demonstrates that aloe vera fiber can serve as a sustainable and eco-friendly material for developing value-added home décor products.

Furthermore, the research highlights the broader potential of agro-waste fibers in sustainable product development. The use of natural dyes and eco-friendly mordants offers an effective alternative to synthetic materials while maintaining both aesthetic and functional qualities. The integration of agro-waste utilization, natural dyeing, and handcrafted techniques provides a promising approach for environmental conservation and socio-economic development.

Overall, continued research and innovation in this area can further enhance the applications of agro-waste fibers in sustainable home décor and textile industries.

REFERENCES

1. Karuppuchamy, A., Ramya, K., & Siva, R. (2024). Novel banana core stem fiber from agricultural biomass for lightweight textile applications. *Industrial Crops and Products*, *209*, 117985.
2. Madhu P, Rangappa SM, Senthamaraikannan P, Pradeep S, Siengchin S, Jawaid M, et al. *Effect of various chemical treatments of Prosopis juliflora fibers as composite reinforcement: physicochemical, thermal, mechanical, and morphological properties*. J Nat Fibers 2018:1e12. https:// doi.org/10.1080/15440478.2018.1534191
3. Oyedeji, S., Patel, N., Krishnamurthy, R., & Fatoba, P. O. (2024). Agricultural wastes to value-added products: economic and environmental perspectives for waste conversion. *Biowaste to Value-added Products: Economics and Technologies*, 215-248.
4. Rana, P., & Sethi, S. (2025). Utilising agro-waste in textile industry: advancing sustainability with a year-round waste cycle. *Materials Circular Economy*, *7*(1), 30.
5. Suparno O. *Upaya potensi dan masa depan serat alam Indonesia sebagai bahan baku aneka industri. Jurnal Teknologi Industri Pertanian* 2020;30(2):221e7. https:// doi.org/10.24961/j.tek.ind.pert.2020.30.2.221.
6. Vinod A, Rangappa SM, Suchart S, Jyotishkumar P. *Renewable and sustainable biobased materials: an assessment on biofibers, biofilms, biopolymers and biocomposites.* J Clean Prod 2020;258(10):12097. https:// doi.org/10.1016/j.jclepro.2020.120978.