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Changing Wood Waste into High-Value Economic Resources

Marwahyudi[1,*], Dian Muhammad Rifai[2], Dea Syahnas Paradita[3], Aura Chandra Kirana[4], Kidung Tirta Sukma Sadhana[5], Farida Syafitri[6]

1 Universitas Sahid, Surakarta, Indonesia

* E-mail: marwahyudineliti@gmail.com

ABSTRACT

This waste generally consists of wood chips, sawdust, small cuttings, and unused wood chunks. The sawmill industry generates approximately 40.48% waste, comprising slabs (22.32%), wood cuttings (9.39%), and sawdust (8.77%). These wood residues are typically not utilized by the sawmill industry. Wood waste has the potential to be transformed into high-value economic products.This study aims to explore the utilization of wood waste in the development of innovative products. Through a creative recycling approach and the application of simple technologies, wood waste is converted into a new source of income while simultaneously reducing environmental impacts. The method employed involves sorting the waste by size, wood fiber characteristics, and wood color. The results of the study indicate that the wood waste can be transformed into more valuable products such as keychains, flash drive holders, and watch cases. Additionally, it can be used as decorative ornaments for interior design and other types of furniture, offering not only economic benefits but also supporting the principles of circular economy and sustainable development.

KEYWORDS: wood waste, circular economy, added value, innovative product.

INTRODUCTION

The wood processing industry, encompassing carpentry, furniture manufacturing, and construction, generates substantial quantities of wood waste annually. This waste typically comprises wood chips, sawdust, small off-cuts, and unused timber blocks. According to Joko Purwanto, the sawmilling sector alone produces wood residues amounting to 40.48 % of its input volume, composed of slabs (22.32 %), wood off-cuts (9.39 %), and sawdust (8.77 %) (Purwanto, 2009). In contrast, the plywood industry yields 54.81 % waste by volume, including core veneer off-cuts (3.69 %), residual core peelings (18.25 %), and wet veneer (8.50 %) (Al Farobi & Mardiana, 2024; PUPR, 2021; Purwanto, 2009). If inadequately managed, such waste poses significant environmental risks, including pollution and the accumulation of debris in industrial zones or nearby communities.

Despite these concerns, wood waste presents a considerable opportunity for upcycling into high-value products. Through the application of creative recycling techniques and simple technologies, residues can be transformed into bioenergy briquettes, particleboard, artisanal crafts, and eco-friendly construction components. For example, experimental work has demonstrated that blending sawdust and wood off-cuts with white glue, cyanoacrylate ("super") adhesive, and epoxy resin—molded into flat or curved panels and finished with varnish—yields novel sheet materials suitable for furniture items such as bedside tables and desks (Al Farobi & Mardiana, 2024; Marwahyudi et al., 2024; Purwanto, 2009; Safarizki & Marwahyudi, 2020).

Such valorisation efforts not only generate additional economic value but also align with sustainable development goals by minimising waste of natural resources. Consequently, the development of targeted strategies and technologies for wood-waste recycling is imperative to advance a circular economy framework and empower local communities.

METHODOLOGY

The methodology employed in this study comprises several key stages, as outlined below:

1. Identification and Collection of Wood Waste

The initial step involves identifying the types of wood waste available at production sites or processing areas. This waste may include sawdust, small wood off-cuts, leftover chunks, and wood fragments originating from furniture manufacturing, construction, or carpentry activities. The collected waste is then classified based on size, wood species, and grain direction (Al Farobi & Mardiana, 2024; Nirmalasari et al., 2021; Sihombing, 2014; Sudjatmiko & Rahman, 2020). Further classification is conducted to assess the processing potential of each type of waste. The analysis focuses on factors such as wood type, dimensions, and potential applications.

The classified waste is then mapped to specific product design categories. For example, small wood fragments may be suitable for handicrafts or home décor, while mixed wood residues can be used for the production of small tables, shelving units, or particle boards.

2. Production Process

The production stage is carried out according to the previously developed designs. It may include the following steps:

a. Re-cutting or reshaping the wood waste,
b. Pressing, gluing, and molding processes (for briquettes or particleboard),
c. Finishing and coloring (particularly for crafts or small furniture items).

3. Product Evaluation

The final products are evaluated in terms of strength, aesthetics, safety, and functionality. This assessment is crucial to ensure market acceptance and verify that the products meet specific quality standards.

Figure 1

Figure of wood scraps and sawdust waste."

Wood scraps are separated based on size, grain direction, and color. These are then selected as materials for economically valuable products. Sawdust is made into simple boards using an adhesive mixture. Once turned into boards, they can be used to create single-house decorative elements. Below are examples of works made from wood waste (Enriko et al., 2024; Kartikawati, 2024; Pramudiananta & Soewarno, 2024).

Figure 2

Figure of boards made from wood waste."

Wood scraps are separated and made into boards. These boards are then utilized as materials for economically valuable products (Marwahyudi, 2020; Mustaan & Yulianto, 2014; Nugraha, 2018).

RESULTS AND DISCUSSION

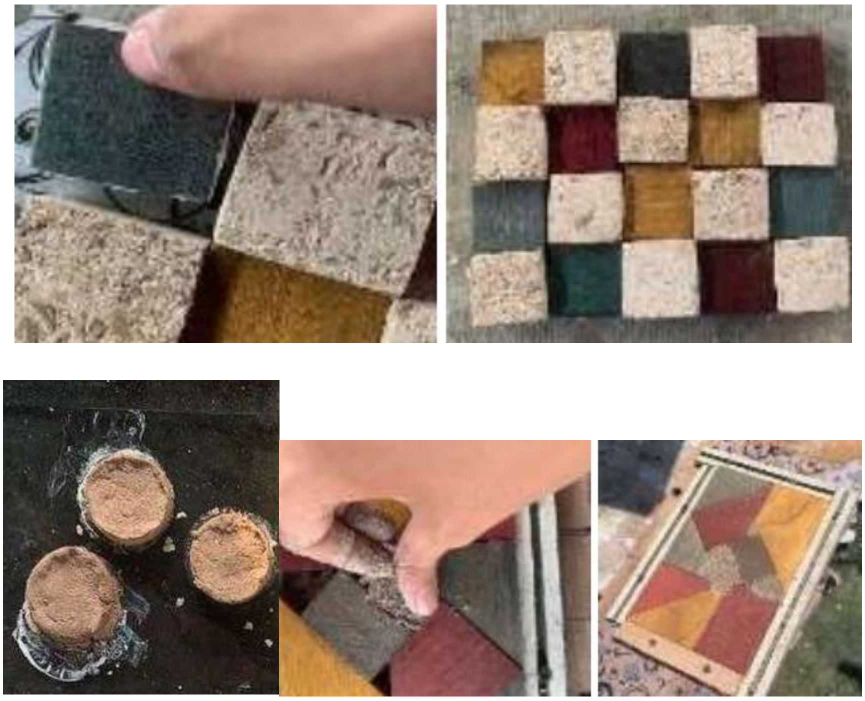
Wood industry waste is abundantly available, as evidenced by the veneer assembly process, which includes face veneer, core veneer, and back veneer. The core veneer is coated with adhesive and pressed. The pressing process yields plywood, which is then trimmed along the edges using a double-sizer machine to achieve square dimensions according to the established standards. The waste produced from this trimming process consists of plywood edge offcuts, amounting to 3.90%. After the volume and grade of the dolok wood are measured, it is cut to the desired length using a chainsaw. The waste generated from this activity includes dolok wood offcuts (3.69%) and sawdust (0.61%).

In the edging process, sawn timber is trimmed to meet width and thickness specifications, then sent to the trimmer saw for further processing. The purpose is to square the wood and remove any defects such as knots, cracks, or splits. Waste produced from the trimmer process consists of wood offcuts amounting to 9.39%.

The average annual wood waste generated by sawmill industries is 40.48% of the total volume, consisting of slabs (22.32%), wood offcuts (9.39%), and sawdust (8.77%). This waste is typically used as fuel for boilers. If the industry is an integrated wood processing facility, the waste is used as core material for blockboards and particle boards.

In plywood industries, the average annual waste is 54.81% of the total volume, consisting of dolok offcuts (3.69%), dolok peeling waste (18.25%), wet veneer (8.50%), shrinkage loss (3.69%), dry veneer (9.60%), thickness reduction in dry veneer (1.90%), plywood edge offcuts (3.90%), sawdust (2.21%), and plywood dust (3.07%). Some of this waste is used as boiler fuel, as joint material for core or back veneers, or—if the facility includes blockboard and particleboard production—as raw material for core boards and particleboard manufacturing. This waste is then processed into decorative materials as follows:

Figure 3
Figure of sawdust waste processing.



Sawdust is made into simple boards using an adhesive mixture. Once the boards are colored, they can be used to create decorative elements for single houses.

Figure 4
Figure of sawdust waste application."

Wood scraps that have no economic value can be used in the building above, enhancing its elegant appearance and transforming the wood waste into something of economic value.

CONCLUSION

To achieve optimal results in this process, special attention must be given to the combination of wood waste, which requires in-depth experimentation to improve outcomes. The finishing process has also not yet produced satisfactory results, indicating the need for further study. Transforming wood waste into economically valuable materials is an effective and sustainable solution to waste problems, while also creating new economic opportunities. Through innovation and creativity, wood waste that was once considered useless can be transformed into a range of products, including handicrafts, furniture, and alternative building materials.

This effort not only brings economic benefits in the form of increased income and business opportunities, but also has a positive environmental impact by reducing waste and minimizing forest exploitation. Moreover, the utilization of wood waste also promotes community empowerment and the development of local skills. Therefore, processing wood waste is a strategic step towards a circular economy and sustainable development.

The results obtained from sorting waste materials—namely, wood scraps and sawdust, which are the main issues in the furniture industry—were followed by step-by-step experiments. These included combining sawdust with white cement and white glue; coloring the sawdust using food coloring and textile dye; coloring the wood scraps using food coloring and textile dye; creating wood pattern motifs such as checkerboard, abstract, alternating, and vertical stripes; combining sawdust and wood scraps using white glue, super glue, and epoxy glue in both flat and curved forms; and applying a varnish finish.

Based on the experiments conducted, the resulting materials can be utilized as new sheet-like materials in the creation of various products, including furniture items such as nightstands and tables.

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