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Recycled plastic as a wood substitute in interior design

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Abstract

This study investigates consumer perceptions and the market viability of recycled plastic as a sustainable substitute for wood in interior design. With the rising global demand for eco-friendly materials, recycled plastic offers a promising alternative to traditional wood, potentially reducing deforestation and waste. The study employs a mixed-methods approach, incorporating quantitative surveys to capture consumer attitudes and preferences, as well as qualitative case studies to understand market trends and practical applications. Findings reveal that while consumers appreciate the environmental benefits of recycled plastic, concerns about durability, aesthetic appeal, and cost affect their willingness to adopt it widely. Furthermore, the analysis identifies a positive trend in acceptance among younger, environmentally conscious consumers, indicating a growing market potential. However, successful adoption in interior design requires addressing perceived quality gaps and enhancing product design to compete with traditional materials. The study concludes that recycled plastic, with targeted improvements and strategic marketing, could play a pivotal role in sustainable interior design, contributing significantly to both ecological conservation and market diversification.

Keywords: Recycled plastic, wood substitute, sustainable materials, sustainable materials, recycled plastic, wood substitutes, zero-waste, circular economy

1. Introduction

The interior design industry has long relied on wood for its aesthetic appeal, versatility, and durability. However, growing concerns about deforestation, environmental degradation, and the sustainability of traditional materials have prompted a search for alternative materials. One such alternative gaining attention is recycled plastic, which can be repurposed into products that mimic the properties of wood. This research investigates the potential of recycled plastic as a viable wood substitute in interior design, focusing on its sustainability, practicality and aesthetic value.

The aim of this study is to evaluate the feasibility of using recycled plastic in various interior design applications, such as furniture, wall panels, flooring, and decorative elements. By understanding the benefits and challenges associated with recycled plastic, this paper seeks to contribute to the development of sustainable design practices and promote a

circular economy within the industry.

2. Materials and Methods

2.1 Materials

This study uses a mixed-methods approach to assess the feasibility of recycled plastic as a sustainable alternative to wood in interior design. Primary data will be collected through surveys of consumers to assess perceptions and usability. Secondary data will include case studies and analysis of existing products made from recycled plastic. Comparison will evaluate strength, aesthetics, and cost-effectiveness against traditional wood.

The results focus on delivering actionable insights about the practices of eco-friendly interior design.

2.2 Methodology

2.2.1 Literature Review: 1. Use of Recyclable Materials in Interior Design (Albina Dervishi).

Inferences: This study explores the integration of recyclable materials into interior design as a strategy to advance sustainable building practices and mitigate environmental impacts. Key findings include:

1. **Environmental Impact:** Recycling aids in pollution prevention, energy conservation, and greenhouse gas reduction.
2. **Economic and Social Aspects:** Recycling reduces building costs, creates jobs, and fosters awareness of sustainability, contributing to cultural shifts.
3. **Recycling Practices in Albania**
 - Wood is the most commonly recycled material, with plastics, metals, and glass as alternatives.
 - Recycling is limited to urban regions, and infrastructure remains underdeveloped.
4. **Application in Design:** Recycled materials are used for furniture, partitions, and decorative elements.
5. **Challenges:** Limited public awareness and inefficient waste management hinder widespread adoption.

2. Exploring Indonesia’s Recycled-Plastic Waste in Interior Design (Polin Marsahala)

Inferences: The research investigates Indonesia’s potential for recycled plastic in sustainable interior design. Highlights include:

1. **Plastic Waste Management:** A local initiative led by the Dalang community has innovated methods to transform plastic into interior-use materials resembling wood.
2. **Sustainability**
 - Recycled plastic reduces deforestation and energy consumption.
 - It aligns with UN SDGs for responsible production.
3. **Material characteristics**
 - Offers durability, moldability, and aesthetic flexibility.
 - Challenges include odour and toxicity during processing.
4. **Design Applications:** Modular furniture, partitions, and cultural-inspired designs integrate recycled plastic effectively.
5. **Environmental and Cultural Value:** The approach reduces waste while incorporating cultural motifs like the Javanese kawung.

2.2.2 Case Studies of Recycled Plastic in Interior Design

1. Elicon industries

- They specialize in offering recycled plastic sheets, pallets, and shuttering sheets, contributing to sustainability.
- Their products focus on reducing environmental impact by reusing plastic waste.
- Products are designed for strength, wear resistance, and high performance in tough environments.
- Elicon provides tailored solutions based on client requirements, including sizes and finishes.



Fig 1: Recycled plastic sheet from elicon industry



Fig 2: Recycled plastic sheet used as a substitute to MDF

2. Polygood Translucent Panels (The Good Plastic Company)

- Crafted from post-consumer recycled plastic, supporting a closed-loop recycling system.
- Aesthetic and functional features include translucency for natural light, soundproofing, and adaptability for diverse design contexts.
- Benefits include reduced environmental footprint, moisture resistance, and biophilic design compatibility.



Fig 3: Opaque patterned panel from Polygood



Fig 4: Translucent patterned panel from Polygood

plastics are derived from fossil fuels, using raw petrochemical feedstocks like ethylene and propylene, which are polymerized to create materials with consistent and clean characteristics, ensuring wide applicability. In contrast, recycled plastics are produced from post-consumer waste or industrial leftovers through mechanical or chemical recycling. Mechanical recycling involves processes like crushing, washing, and reprocessing, often enhanced with compatibilizers to improve mechanical properties. Chemical recycling breaks down plastics into monomers, which are repolymerized to achieve properties close to virgin plastics. While virgin plastics are available in forms like pellets, granules, sheets, and films for industries such as packaging, automotive, and construction, recycled plastics are also produced in similar forms, including composites like Wood-Plastic Composites. Despite differences in consistency and quality, advancements in recycling technologies are improving the reliability and market recognition of recycled plastics, which offer environmental benefits by reducing waste and conserving resources.

3. Comparative Framework

Virgin and recycled plastics differ in their composition, production methods, and market applications. Virgin

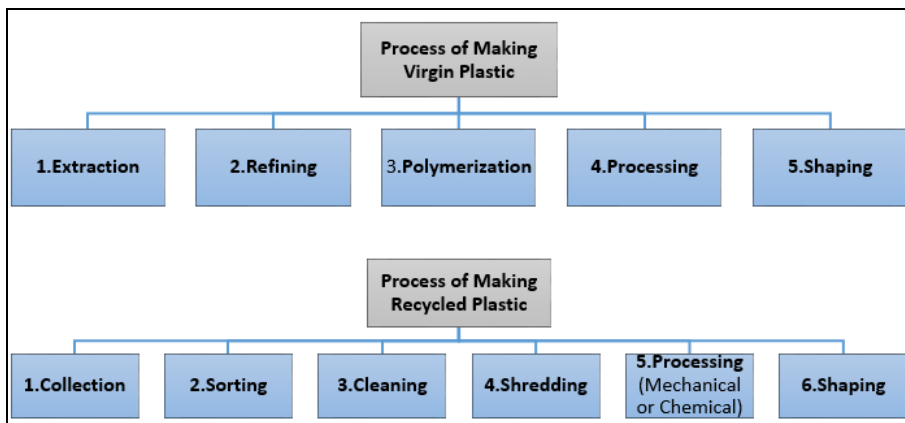


Fig 5: Recycled plastic pellets



Fig 6: Virgin plastic pellets

Type of Recycled plastic	Characteristics	Application in interior design	Available form
1. Polyethylene Terephthalate (PET or PETE)	Lightweight, clear, strong, and recyclable.	Building: Insulated panels, carpets. Furniture: Upholstery, recycled fillings for cushions.	Pellets, flakes, fibers.
2. High-Density Polyethylene (HDPE)	Strong, durable, resistant to moisture and chemicals.	Construction: Plastic timber, roofing sheets. Furniture: Outdoor furniture, composite panels.	Sheets, granules, pellets.
3. Polyvinyl Chloride (PVC)	Flexible or rigid, chemically resistant.	Interiors: Vinyl flooring, wall panels. Furniture: Faux leather, flexible tubing.	Sheets, granules.
4. Low-Density Polyethylene (LDPE)	Lightweight, flexible, transparent.	Home Decor: Lightweight storage solutions. Building: Protective films, insulation.	Films, granules.
5. Polypropylene (PP)	Rigid, durable, heat-resistant.	Construction: Durable panels, weather-resistant furniture. Furniture: Molded chairs, organizers.	Pellets, sheets, fibers.
6. Polystyrene (PS)	Lightweight, insulating, brittle.	Building: Insulation boards, decorative moldings. Furniture: Lightweight decorative elements.	Sheets, blocks, beads.
7. Polylactic Acid (PLA)	Biodegradable, made from renewable sources like corn starch.	Furniture: Sustainable decor items, 3D-printed furniture components. Home Accessories: Compostable storage solutions.	Filaments, pellets.
8. Acrylonitrile Butadiene Styrene (ABS)	Strong, impact-resistant, versatile.	Furniture: Customizable 3D-printed parts. Decor: Durable fixtures.	Pellets, sheets, filaments.
9. Mixed Plastics (Composite Materials)	Combination of multiple plastics, less recyclable.	Construction: Flooring, structural panels. Furniture: Composite furniture pieces.	Boards, panels.

4. Cost Analysis of Recycled Plastic and Wood

- **Material Costs:** Recycled plastic materials generally offer a cost advantage over virgin materials. For instance, using recycled plastic in wood-plastic composites significantly reduces material costs compared to using virgin materials. In the context of thermoplastic composites, unfilled recycled plastic is noted as the cheapest solution, especially when the covered volume is important. Additionally, the use of recycled high-density polyethylene (HDPE) in composites production not only reduces costs but also provides environmental benefits by avoiding waste disposal impacts.
- **Manufacturing Costs:** The manufacturing costs of composites using recycled materials do not show significant changes compared to those using virgin materials. This suggests that the primary cost benefits of using recycled materials are derived from the reduction in material costs rather than manufacturing efficiencies.
- **Life Cycle Costs:** When considering life cycle costs, recycled plastic materials can lead to savings in various applications. For example, using recycled plastic aggregates in concrete structures can result in life cycle cost savings of up to 5.9%, depending on the structural configuration. Similarly, the life cycle cost analysis of polyplank materials, which include recycled plastics, shows that while the initial cost is higher than traditional wood, the overall life cycle cost is lower due to reduced maintenance requirements.

5. Aesthetic Considerations

- **Color Changes and Degradation:** Recycled plastic composites, such as those made from high-density polyethylene (HDPE) and wood, can experience significant aesthetic degradation over time. This includes noticeable color changes and variations in lightness, especially when exposed to environmental factors like UV light and termite attacks.
- **Visual Appeal:** While recycled plastics are durable and long-lasting, they may be perceived as less aesthetically

pleasing compared to natural wood. This is particularly relevant in applications where the natural appearance of wood is valued, such as in parks and recreation areas.

- **Artistic and Functional Design:** In interior design, recycled materials, including wood and metal waste, have been successfully used to create aesthetically pleasing and functional artworks. These designs highlight the potential for recycled materials to meet high aesthetic standards when creatively applied.

When comparing the durability of recycled plastic to natural wood, recycled plastics, particularly in the form of wood-plastic composites (WPCs), generally offer superior durability and longevity in certain applications, especially outdoor settings.

6. Durability

Durability of Recycled Plastic

- **Weather Resistance:** Recycled plastic composites often show better resistance to weathering compared to natural wood. For instance, WPCs made from recycled plastics exhibit improved resistance to chemical agents and aging, making them suitable for outdoor applications like decking.
- **Mechanical Properties:** While the mechanical properties of recycled plastic composites can be reduced after exposure to environmental conditions, such as freeze-thaw cycles, they still maintain a level of durability that is often superior to natural wood.
- **Water Resistance:** Recycled plastic composites tend to have lower water absorption rates compared to natural wood, which contributes to their enhanced durability in moist environments.

Durability of Natural Wood

- **Biological Performance:** Natural wood, especially when treated with preservatives like chromated copper arsenate (CCA), can exhibit good durability against biological threats such as termites and fungi. However, untreated wood is generally more susceptible to these threats compared to recycled plastic composites.

- **Dimensional Stability:** Natural wood can suffer from dimensional instability due to moisture absorption, leading to swelling and warping, which is less of an issue with recycled plastic composites.

7. Benefits of Recycled Plastic in Interior Design

1. Waste Reduction

- Recycled plastic helps divert plastic waste from landfills and oceans, reducing pollution and waste accumulation.
- It provides a second life to materials that would otherwise contribute to environmental degradation.

2. Resource Conservation

- By using recycled plastic, the demand for virgin plastic production is reduced, conserving fossil fuels and raw materials.
- It minimizes the extraction of natural resources like wood, offering a sustainable alternative in furniture and paneling.

3. Energy Efficiency

- Recycling plastic consumes significantly less energy compared to manufacturing new plastic from raw materials.
- The lower energy consumption leads to a reduced carbon footprint during the production process.

4. Reduction in Deforestation

- Recycled plastic can substitute for wood in furniture, wall panels, and flooring, reducing the need for timber and preserving forests.

5. Longevity and Durability

- Products made from recycled plastic are often long-lasting, reducing the need for frequent replacements and thereby conserving resources.

6. Lower Carbon Emissions

- The recycling process emits fewer greenhouse gases compared to producing new plastic, aiding in climate change mitigation.

7. Support for Circular Economy

- Incorporating recycled plastic promotes a circular economy where materials are reused, recycled, and repurposed, reducing the linear waste model.

8. Innovative Design Opportunities

- Recycled plastic can be molded into unique shapes, textures, and finishes, allowing designers to create aesthetically pleasing and sustainable interiors without compromising on creativity.

9. Resistance to Environmental Damage

- Recycled plastic materials are often resistant to water, termites, and UV rays, reducing maintenance costs and resource use over time.

8. Limitations of Recycled Plastic in Interior Design

Mechanical Properties: While recycled plastic composites can achieve high stiffness and strength, they often require additives like compatibilizers to enhance these properties. Natural wood inherently possesses desirable mechanical properties without the need for such additives.

Thermal and Environmental Stability

Recycled plastic composites exhibit high thermal stability, making them suitable for high-temperature applications. However, their performance in terms of fire resistance, weather resistance, and ultraviolet resistance needs careful assessment, which is less of a concern with natural wood.

Moisture Absorption and Dimensional Stability

Recycled plastics can have issues with moisture absorption and dimensional stability, which are critical for interior applications. Natural wood, when properly treated, generally offers better performance in these areas.

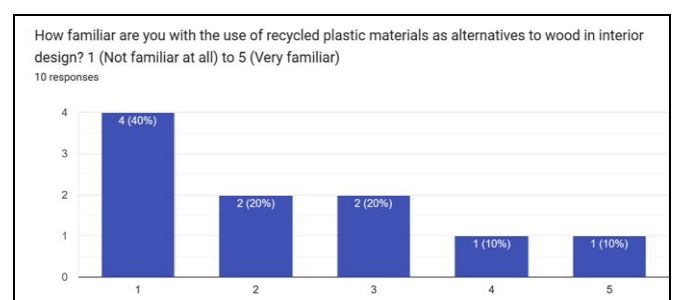
Toxicity Concerns: The presence of heavy metals like cadmium, chromium, and lead in recycled plastics, often from electronic waste, poses potential health risks. These contaminants are not typically a concern with natural wood.

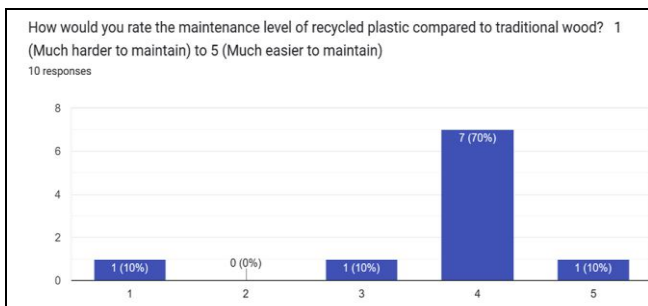
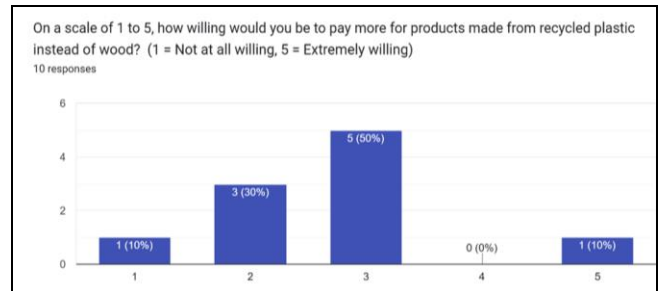
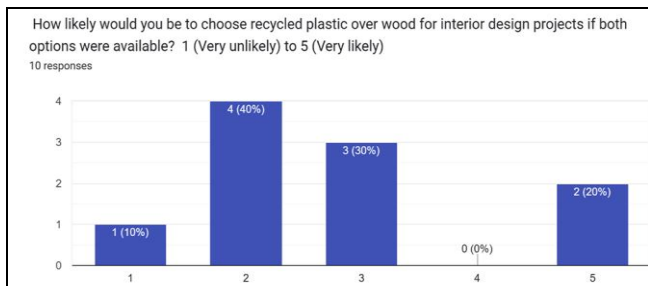
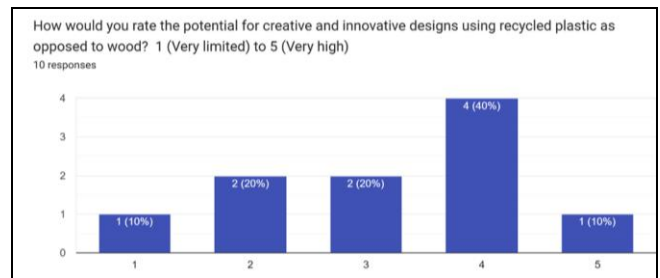
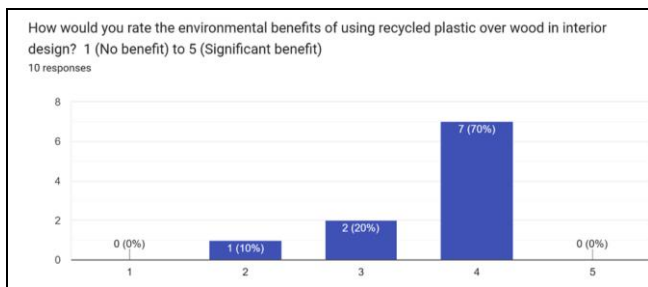
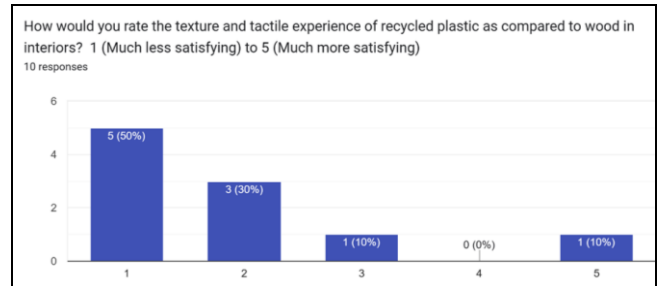
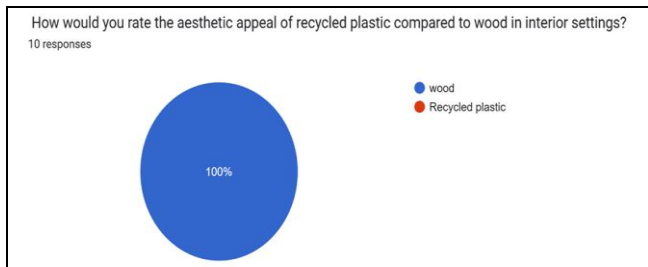
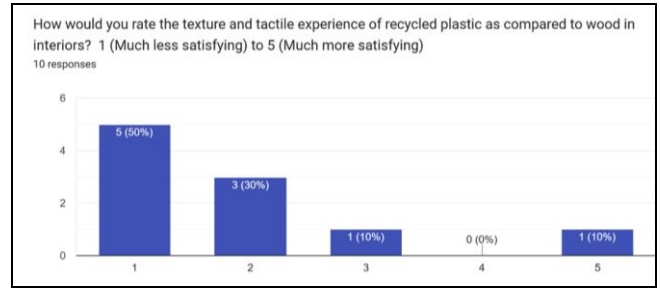
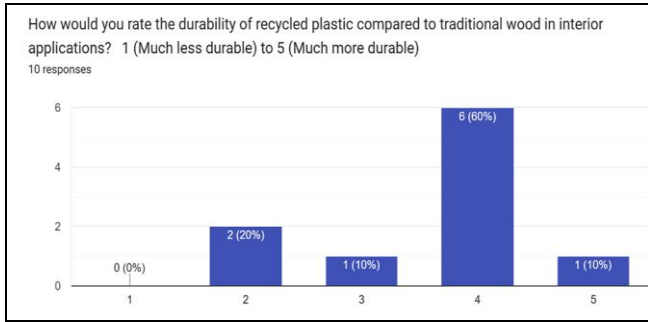
Aesthetic and Textural Qualities

Natural wood offers unique aesthetic and textural qualities that are difficult to replicate with recycled plastics. The natural grain and warmth of wood are often preferred in interior design for their visual appeal and tactile experience.

Recyclability and Sustainability: While recycled plastics promote closed-loop recycling, their long-term recyclability and degradation over time can be problematic. Natural wood, being biodegradable, offers more sustainable lifecycle.

9. Data Analysis: This questionnaire explores perceptions, preferences, and concerns about the use of recycled plastic as an alternative to wood and in interior design applications. This questionnaire aims to collect insights about durability, aesthetics, environmental benefits, safety, maintenance, and creative potential of recycled plastic compared to traditional materials. This research explores responses toward the factors of acceptance and adoption of recycled plastic as an interior space material while looking for the opportunity in terms of promoting usage of a sustainable and innovative material through the design industry.





10. Results

Based on the questionnaires, participants were generally moderately familiar with using recycled plastic instead of wood as an alternative in interior design. The scores ranged from 1 (not at all familiar) to 5 (very familiar). In terms of opinions on the durability of the material, a majority rated recycled plastic to be similar to or even more durable than wood. But when it came to aesthetics, the majority leaned towards wood—a perception of which is that wood looks better and feels better than steel in general. Environmental benefits were recognized, as most participants acknowledged significant advantages in using recycled plastic over wood, highlighting sustainability as a key driver. Despite this, the likelihood of choosing recycled plastic over wood varied, indicating hesitancy likely influenced by concerns about safety, toxicity, or the sensory experience of plastic.

Regarding maintenance, it was perceived to be more manageable, as recycled plastic is known for being very resistant to wear and tear. Safety and toxicity, however, were considered among the major issues. Some responses

showed that health risks are more important indoors. Recycled plastic creativity was scored as average. That is, while there are indeed many innovative designs, they are not yet on par with the versatility of wood.

Finally, willingness to pay a premium for products made from recycled plastic was a mixed bag. Respondents were either very open or willing to accept it-reflecting alignment with sustainability values or were hesitant; perhaps the price or an aesthetic or functionality trade-off. Overall, the results indicated an opportunity for education and innovation to improve the acceptability of recycled plastic for interior design.

11. Conclusion

Recycled plastic offers exceptional durability, outperforming wood in its resistance to wear, moisture, and pests, making it a more practical choice for long-term use. Additionally, its ease of maintenance ensures that it remains an efficient and cost-effective option for homeowners and designers alike.

From an environmental perspective, recycled plastic is significantly superior. Unlike virgin plastic, which relies on the extraction of non-renewable resources, recycled plastic repurposes waste materials, reducing landfill overflow and minimizing carbon emissions. Compared to wood, it eliminates the need for deforestation, preserving natural ecosystems and biodiversity while providing a sustainable alternative that aligns with global efforts to combat climate change.

While recycled plastics pose some challenges in interior design, such as mechanical properties, thermal stability, and toxicity concerns, research and technological advancements are underway to provide solutions. Eco-friendly additives, improved moisture resistance, and integration of natural materials can significantly enhance the performance and sustainability of recycled plastics. Moreover, fire resistance and UV protection will be covered with innovative coatings and treatments of recycled plastics, making it an alternative to natural wood. These improvements will help the use of recycled plastics in interior design become more sustainable and effective, in line with the increased demand for environmentally responsible materials.

12. References

- Marsahala P, Nediari A, Roesli C. Exploring Indonesia's recycled-plastic waste material in interior design for sustainable interior eco-planning. *IOP Conf Ser Earth Environ Sci.* 2023;1169:012049. doi:10.1088/1755-1315/1169/1/012049.
- Lubonja O, Ovidiu F. Use of recyclable materials in interior design. *Eur J Econ Bus Stud.* 2019. doi:10.26417/ejes.v5i2.p79-100.
- Keskisaari A, Kärki T. The use of waste materials in wood-plastic composites and their impact on the profitability of the product. *Resour Conserv Recycl.* 2018. doi:10.1016/J.RESCONREC.2018.03.023.
- Sormunen P, Deviatkin I, Horttanainen M, Kärki T. An evaluation of thermoplastic composite fillers derived from construction and demolition waste based on their economic and environmental characteristics. *J Clean Prod.* 2021;278:125198. doi:10.1016/j.jclepro.2020.125198.
- Andersson A. Jämförande livscykelkostnadsanalys av polyplankmaterial och granvirke. 2019.
- Alqahtani F, Abotaleb I, Elmenshawy M. Life cycle cost analysis of lightweight green concrete utilizing recycled plastic aggregates. *J Build Eng.* 2021;40:102670. doi:10.1016/J.JOBE.2021.102670.
- Faraca G, Martinez-Sanchez V, Astrup T. Environmental life cycle cost assessment: Recycling of hard plastic waste collected at Danish recycling centres. *Resour Conserv Recycl.* 2019;141:186-97. doi:10.1016/J.RESCONREC.2019.01.014.
- López-Naranjo E, Alzate-Gaviria L, Hernández-Zárate G, Reyes-Trujeque J, Cruz-Estrada R. Effect of accelerated weathering and termite attack on the tensile properties and aesthetics of recycled HDPE-pine wood composites. *J Thermoplast Compos Mater.* 2014;27(6):831-44. doi:10.1177/0892705712473625.
- Strotman S. Use of recycled plastics versus wood. 1996.
- Turku I, Kärki T, Puurtinen A. Durability of wood plastic composites manufactured from recycled plastic. *Heliyon.* 2018;4:e00559. doi:10.1016/j.heliyon.2018.e00559.
- Taşcıoğlu C, Tufan M, Yalçın M, Şen S. Determination of biological performance, dimensional stability, mechanical and thermal properties of wood-plastic composites produced from recycled chromated copper arsenate-treated wood. *J Thermoplast Compos Mater.* 2016;29(11):1461-79. doi:10.1177/0892705714565704.
- Irina T, Timo K. Recycled PVC as material for natural fiber composite manufacturing—study of mechanical performance and durability. *J Solid Waste Technol Manag.* 2020;46(1):36-43. doi:10.5276/jswtm/2020.36.
- Vercher J, Fombuena V, Diaz A, Soriano M. Influence of fibre and matrix characteristics on properties and durability of wood-plastic composites in outdoor applications. *J Thermoplast Compos Mater.* 2018;33(4):477-500. doi:10.1177/0892705718807956.
- Strotman S. Use of recycled plastics versus wood. 1996.
- Ribeiro L, Stolz C, Amario M, Da Silva A, Haddad A. Use of post-consumer plastics in the production of wood-plastic composites for building components: A systematic review. *Energies.* 2023;16(18):6549. doi:10.3390/en16186549.
- Sommerhuber P, Wang T, Krause A. Wood-plastic composites as potential applications of recycled plastics of electronic waste and recycled particleboard. *J Clean Prod.* 2016;121:176-85. doi:10.1016/J.JCLEPRO.2016.02.036.
- Ribeiro L, Stolz C, Amario M, Da Silva A, Haddad A. Use of post-consumer plastics in the production of wood-plastic composites for building components: A systematic review. *Energies.* 2023;16(18):6549. doi:10.3390/en16186549.
- Sommerhuber P, Wang T, Krause A. Wood-plastic composites as potential applications of recycled plastics of electronic waste and recycled particleboard. *J Clean Prod.* 2016;121:176-85. doi:10.1016/J.JCLEPRO.2016.02.036.
- Elicon Industries. [Internet]. Available from: <https://eliconindustries.in/>.

20. The Good Plastic Company. [Internet]. Available from: <https://thegoodplasticcompany.com/>.
21. Banyan Nation. [Internet]. Available from: <https://www.banyannation.com/>.
22. Shakti Plastic Industries. [Internet]. Available from: <https://www.shaktiplasticinds.com/>.
23. Plastics for Change. [Internet]. Available from: <https://www.plasticsforchange.org/>.
24. 2050 Materials. [Internet]. Available from: <https://2050-materials.com/>.
25. Archiproducts. 15 pieces of recycled plastic furniture for sustainable design. [Internet]. Available from: https://www.archiproducts.com/en/news/15-pieces-of-recycled-plastic-furniture-for-sustainable-design_101279.

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