(#79) Investigate the Potential of Iluk Plant for The Development of Particle Boards for Interior Applications

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Abstract

The deforestation associated with the production of traditional wood-based particleboards requires the exploration of sustainable alternatives. This research investigates the potential use of *Imperata cylindrica (Iluk),* a fast-growing and readily available perennial grass, as a viable raw material for particleboard specifically designed for interior applications. The study explores the feasibility of substituting the *Iluk* plant for wood in particleboard production. It analyses the mechanical properties (strength, durability, moisture resistance) of *Iluk*-based particleboard compared to conventional alternatives. In addition, a life cycle assessment is conducted to quantify the environmental benefits of using *Iluk*. This research aims to Assess the feasibility of using *Iluk* particles to develop a functional particle board suitable for interior use. Evaluation of performance characteristics of *Iluk*-based particle board compared to conventional particle board. Investigate the environmental benefits associated with using *Iluk* as a sustainable alternative. The findings of this research contribute to the development of sustainable alternatives in the construction and furniture industry. Successful results may lead to a reduced dependence on traditional wood resources and a more environmentally friendly approach to particleboard production.

Keywords*: particle board, Imperata cylindrica (Iluk), sustainability, deforestation, indoor applications, life cycle assessment, Dry leaves*

Introduction

The construction and furniture industry heavily relies on wood-based materials like particleboard. However, concerns regarding deforestation highlight the need for exploring sustainable alternatives. This research investigates the potential of Imperata cylindrica (*Iluk)* as a viable raw material for particleboard specifically designed for interior applications.

Justification for Using *Iluk,*

- *Iluk* is a fast-growing perennial grass native to tropical and subtropical regions. This rapid growth rate offers a readily available and renewable resource compared to traditional wood sources.
- *Iluk* possesses a high cellulose content (around 40-50%) within its stems, a crucial component for binding particles in particleboard.
- Using *Iluk* for particleboard production can provide additional benefits to Sri Lankan farmers in some areas.
- *Iluk* is considered an invasive weed due to its rapid spread. By providing a sustainable economic use for *Iluk*, this research can contribute to managing its invasive tendencies and reducing its negative impact on agricultural land.
- Cultivating and harvesting *Iluk* for particleboard production can create a new source of income for farmers.

Aims and Objective

- To investigate the composition and production processes of existing particleboards.
- To characterize the physical, and mechanical properties of *Iluk* for particle board applications.
- To investigate the available binding agents used in particle boards in the local market.
- To investigate the potential of clay as a sustainable binding agent for *Iluk* particleboard
- To develop and optimize production processes for *Iluk* particle board.

Methodology

This research will explore the potential of *Iluk (Imperata cylindrica*) as a sustainable raw material for particleboard production, focusing on its suitability for Sri Lankan interior applications.

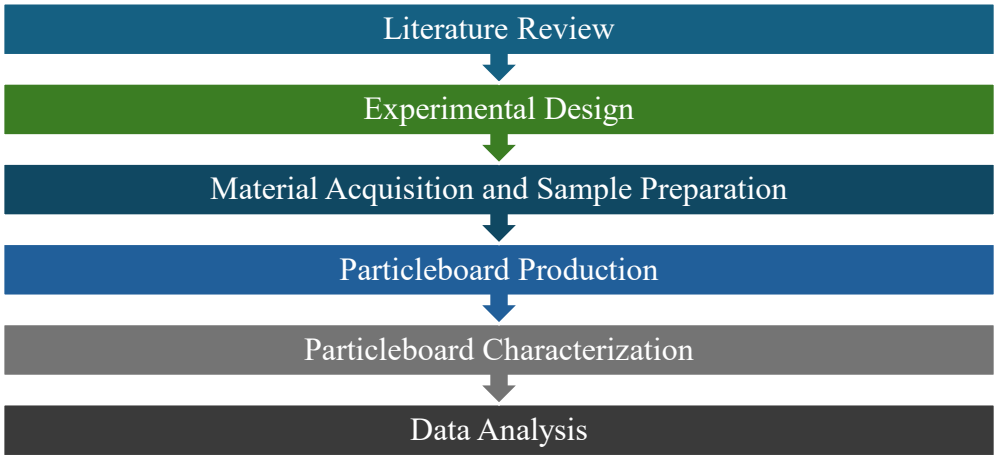


Figure 1: Research Strategy

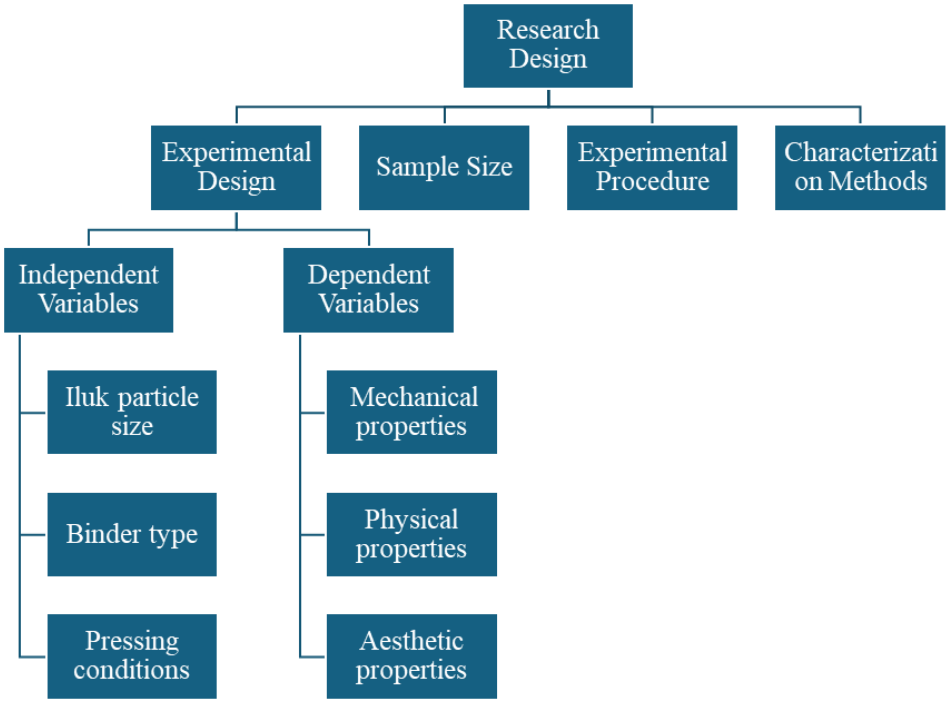


Figure 2: Research Design

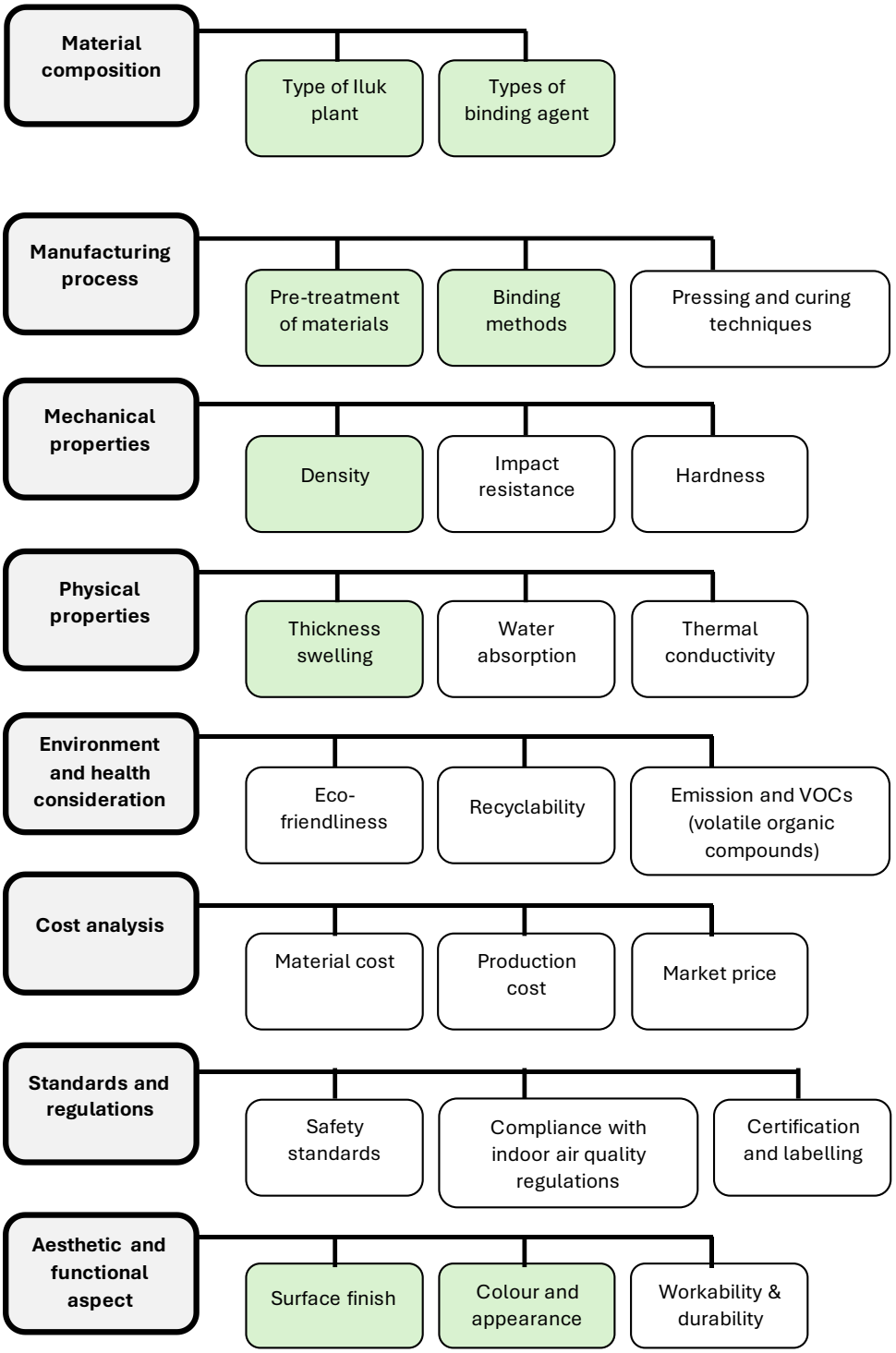


Figure 3: Theoretical Framework

Result And Discussion

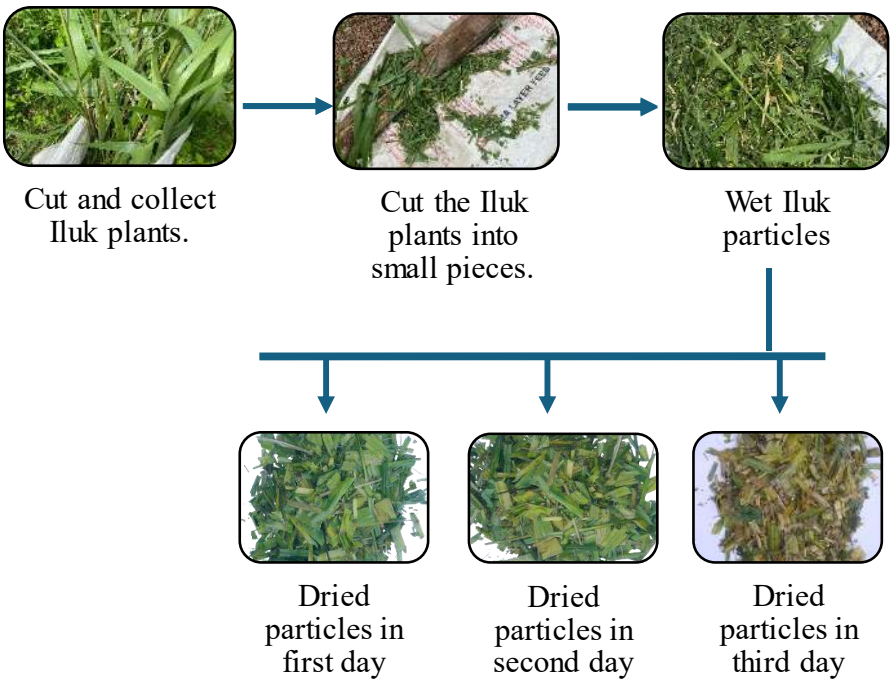


Figure 4: Process of sampling

Experimental steps

- First the clay is seasoned well
    - Clay is often soaked in water for a specific period to hydrate it and improve its plasticity. This can help ensure better distribution and adhesion within the particleboard.
- Mixing with dried *Iluk* particles
    - The mixing of dried *Iluk* particles with the seasoned clay binder is a critical step in the particleboard manufacturing process. This step involves combining the two components to form a mixture that will serve as the particleboard.
- Put the prepared mixture into the mold.
    - The mold is prepared to ensure smooth and even distribution of the mixture.

    - The prepared mixture is carefully pressed into the mold. The mixture was evenly distributed to avoid voids or inconsistencies in the final product.

- compress it well using a hydraulic compression tool.
    - Compressing the particleboard mixture using a hydraulic compression tool is essential to enhance its physical and mechanical properties. This process increases the density of the material, improves its strength, and reduces its porosity.
- Remove the panel from the mold and dry it again.

Test 01

This particle board was made using polymer bind and *Iluk* particles. Here, the plant parts were well dried and mixed with polymer gum, put into the mold, and compressed. After two days in the mold, there was no fixation. From the third day, something like mold was seen on the board. On the fourth and fifth days, the mold spread all over the board. Because of this, this board must be named a failure.

Test 02

This particle board is made from dried *Iluk* plant particles and polyethylene. Heat polythene in a bowl and stir until the polythene melts. Then polyethylene and Iluk are mixed. Then this mixer is put into the mould and compressed

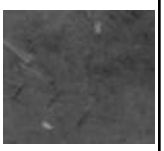
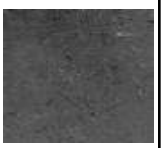
Test 03

This particle board is made using dried *Iluk* particles and seasoned clay. Here, this mixture is made in a ratio of 1:2 of *Iluk* particles and clay. This is allowed to compact for a day at normal ambient temperature and then removed from the mould to dry.

Test 04

This particle board is made using dried *Iluk* particles and seasoned clay. Here, this mixture is made in a ratio of 1:3 of *Iluk* particles and clay. This is allowed to compact for a day at normal ambient temperature and then removed from the mould to dry.

Table I: Test Results

Material	Quantity (g/ ml)	Ratio	Size/ Thickness Weight	Result	
Test 01 **Sun dried Iluk plant particles** **Polymer binder**	**200 g** **200g**	**1:1**	**6"x 6" x 0.5"** **350g**	**Fail**	
Test 02 **Sun dried Iluk plant particles** **Disposable lunch sheets**	**75g** **100g**	**3:4**	**6"x 6" x 0.2"** **120g**	**Average**	
Test 03 **Sun dried Iluk plant particles** **Pre – Treated clay**	**200g** **400g**	**1:2**	**6" x 6" x 1"** **550**	**Success**	
Test 04 **Sun dried Iluk plant particles** **Pre – Treated clay**	**200g** **600g**	**1:3**	**6" x 6" x 1"** **600**	**Success**	
Test 05 **Sun dried Iluk plant particles** **Red clay**	**200g** **400g**	**1:2**	**6" x 6" x 1"** **500**	**Average**	
Test 06 **Sun dried Iluk plant particles** **Red clay**	**200g** **600g**	**1:3**	**6" x 6" x 1"** **750**	**Average**	
Test 07 **Sun dried Iluk plant particles** **Pre – Treated clay**	**200g** **600g**	**1:3**	**6" x 6" x 1"** **600**	**Success**	

Test 05

The materials used here are *Iluk* particles and red clay known as brick clay. There were some cracks in this board while it was drying.

Test 06

The materials used here are *Iluk* particles and red clay known as brick clay. There were some cracks in this board while it was drying.

Test 04

This particle board is made using dried *Iluk* particles and seasoned clay. Here, this mixture is made in a ratio of 1:2 of *Iluk* particles and clay. This is allowed to compress for 2 days at normal ambient temperature and then removed from the mold to dry.

This research utilized pre-treated *Iluk* particles and seasoned clay as the primary materials. The *Iluk* particles were prepared to a specific size and mixed thoroughly with the clay binder. The mixture was then molded and compressed using a hydraulic press to achieve the desired density.

Conclusion

This research investigated *Iluk's* potential as a sustainable particleboard material and clay as a viable, eco-friendly binder. While *Iluk* displayed promising properties like density and tensile strength, pre-treatment was crucial for optimal use. Clay's potential as a binder is evident, but further optimization is needed to match conventional binders in strength and moisture resistance. *Iluk* particleboard prototypes using pre-treated *Iluk*, and clay showed encouraging results for some physical and mechanical properties. However, further refinement is necessary to achieve peak performance across all aspects, such as bending strength and internal bond strength, which are crucial for particleboard applications in furniture and construction.

This research demonstrates the potential to transform *Iluk*, an environmental and economic burden, into a valuable resource for the sustainable building materials industry. Utilizing *Iluk* for particleboard production offers a dual benefit – managing invasive plant growth while providing an eco-friendly alternative to wood-based materials. This approach aligns with the growing

demand for sustainable construction practices that minimize environmental impact.

Directions for Future Research

- This research on *Iluk*-based particleboard lays the groundwork for future exploration in several key areas.
- Investigating different *Iluk* species and pre-treatment methods to improve particleboard performance.
- Exploring formaldehyde-free binding agents for a more environmentally friendly product.
- Using advanced techniques to gain deeper insights into the material properties and performance of *Iluk* particleboard.
- Examining the economic feasibility of *Iluk*-based particleboard production, including production costs, market demand, and economic impact on *Iluk* cultivation and processing.

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