Remanufacturing Mycelium Biocomposites

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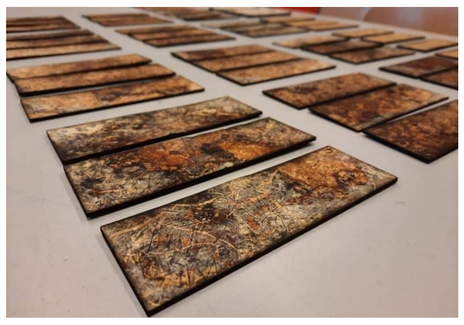
Introduction

The construction sector is responsible for 37% of global CO_2 emissions, driven by its use of synthetic, non-renewable materials [1]. **Mycelium-based composites** (MBCs) offer a sustainable alternative—biodegradable, low-energy to produce, and suitable for circular use [2].

Research question: What is the optimal ratio of spent MBC to pregrown mycelium substrate that maximises strength, thermal insulation, and moisture resistance?



The **MycEoLA project**, led by MNEXT, explores how MBCs can be **reused** or **remanufactured** instead of discarded. This study investigates whether **spent mycelium boards** can be reprocessed into **new boards or foams**, and whether key properties, strength, insulation, and moisture resistance, are maintained across cycles [3]. The goal is to support circular strategies in biobased construction.

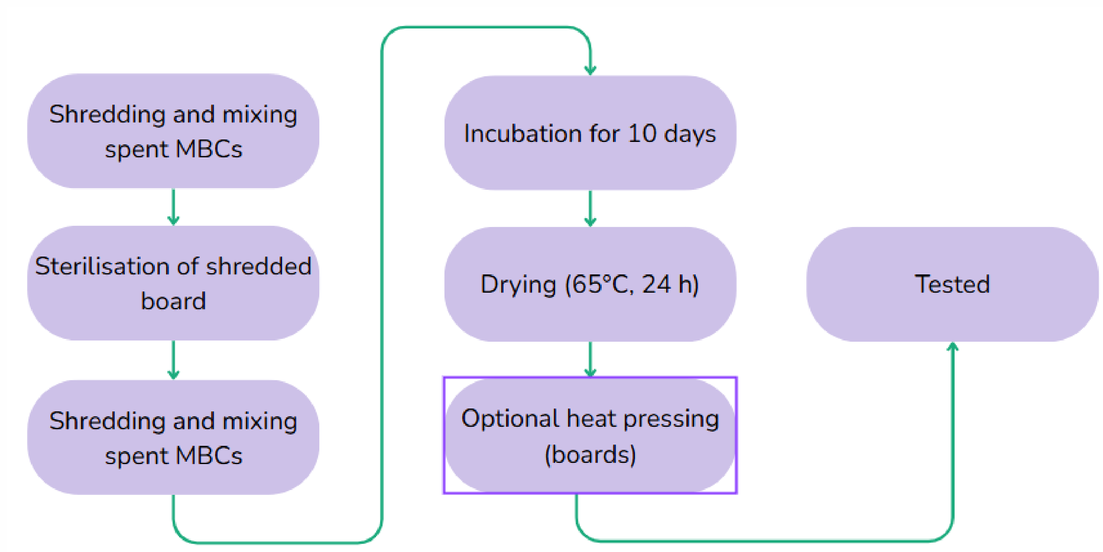
Methodology

Fungal strain: Ganoderma lucidum

Substrate: Hemp straw + nutrient flour

Remanufacturing ratios: **25% and 50%** spent board + pregrown hemp substrate

Processing:



Tested properties:

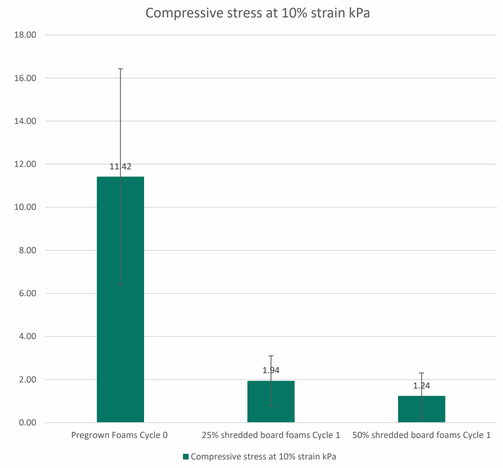
Foams:

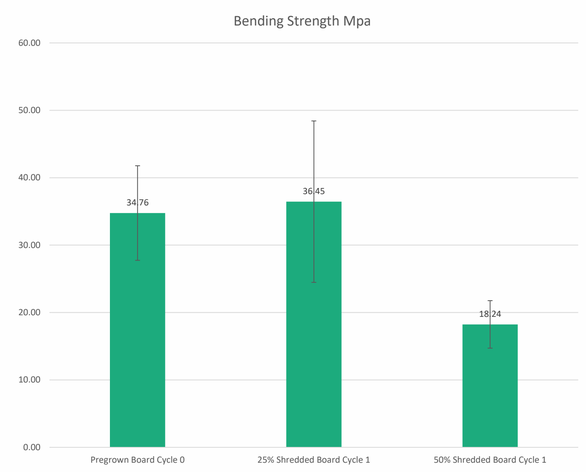
- compressive strength (EN 826
- thermal conductivity (EN 12667)
- water absorption, water contact angle

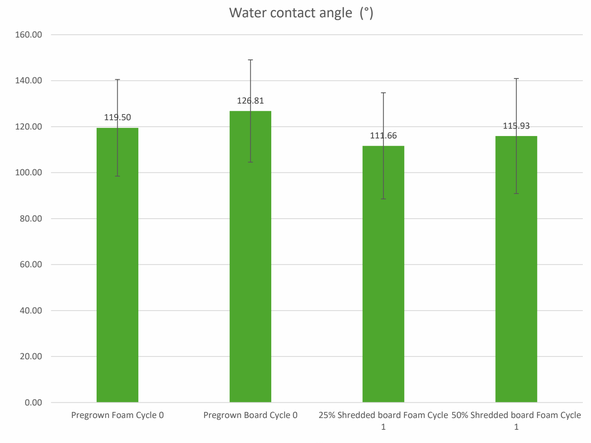
Boards:

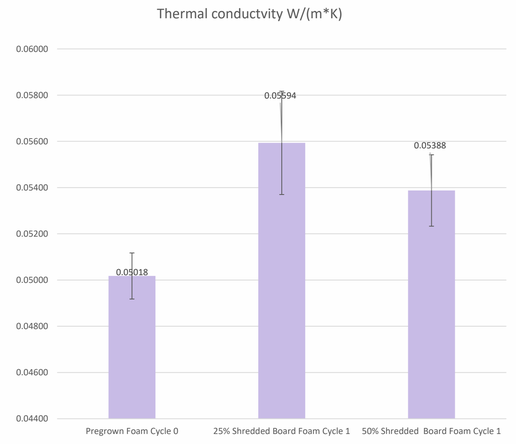
- three-point bending (EN 310)
- water absorption, water contact angle

Results









- Mechanical strength:
  - Cycle 0 > Cycle 1 for compressive and bending strength
- Thermal conductivity:
  - Improved in Cycle 1 vs Cycle 0
- Moisture resistance (absorption and contact angle):
  - Comparable across cycles
- Cycle 2 data: currently in progress

Discussion

- Switching from rapeseed straw to hemp straw & increasing added spawn enhanced growth consistency and decreased contamination rates.
- Thermal insulation properties improved after remanufacturing, possibly due to increased internal density or structure variation
- Structural strength declines suggest cumulative fungal degradation or insufficient recolonization
- Cycle 2 data: currently still being analysed

Reference

1.https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en
2.https://www.sciencedirect.com/science/article/pii/S1364032119308567
3.https://www.arup.com/perspectives/publications/research/section/biomaterials-and-sustainable-construction