MycoMax

Bamboo reinforced load-bearing MBC

MycoMax

Bamboo reinforced load-bearing MBC

MSc Graduation Thesis Presentation

A4 | 17/06/2026 | Janvi Dedhia

Department: MSc. Architecture, Urbanism and-Building Sciences (AUBS)
Track: Building Technology Graduation Studio 2026

First supervisor : Dr. ir. Olga Ioannou
Second supervisor : Prof. dr. Mauro Overend
Internship supervisor : Tjeerd Veenhoven, STV

How do we stop relying on fossil fuels and mined resources and start actually growing our building materials?

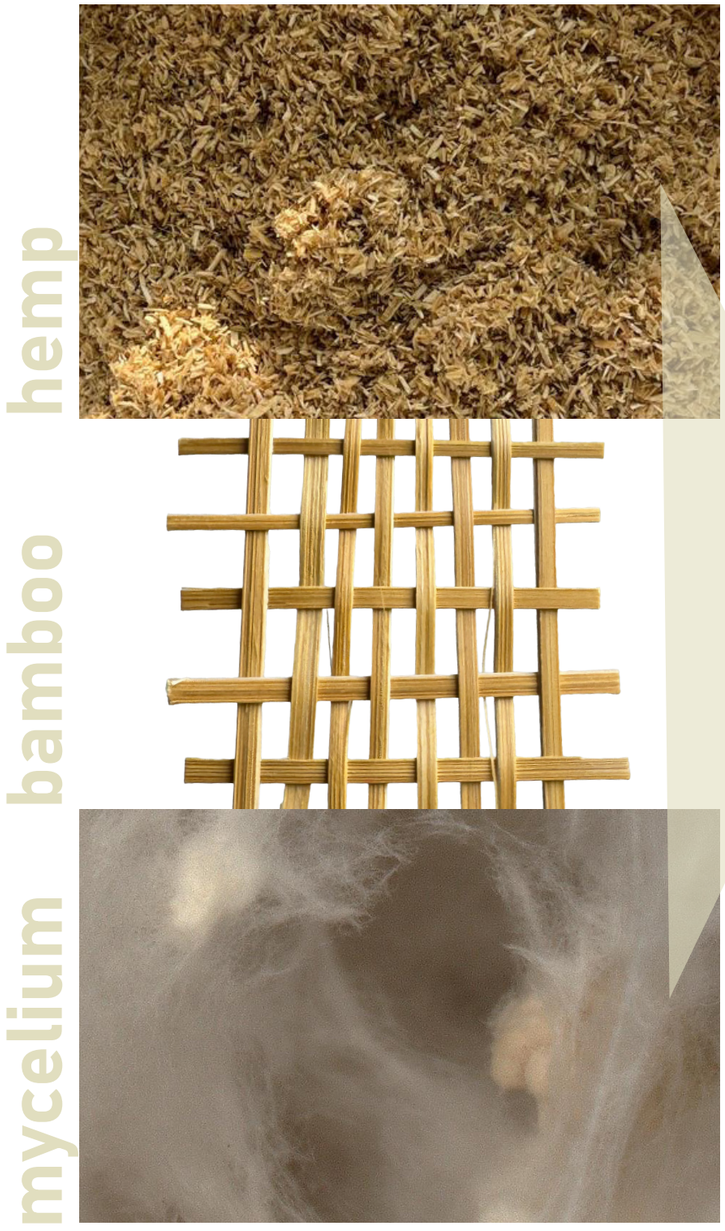
How do we stop relying on fossil fuels and mined resources and start actually growing our building materials?

hemp

bamboo

mycelium

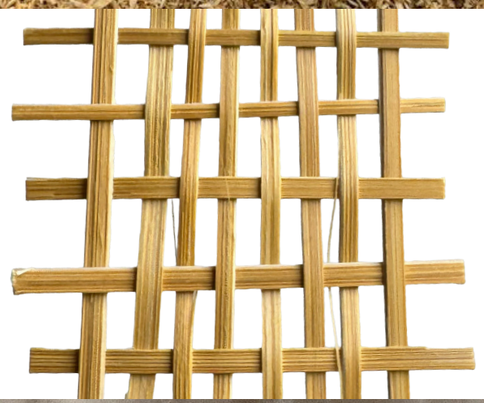
How do we stop relying on fossil fuels and mined resources and start actually growing our building materials?



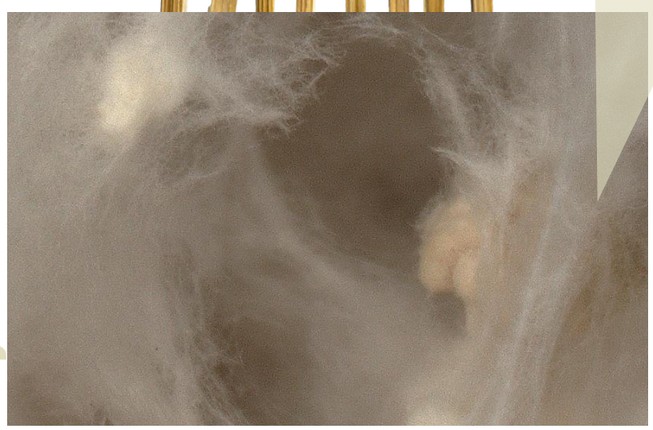
How do we stop relying on fossil fuels and mined resources and start actually growing our building materials?

hemp

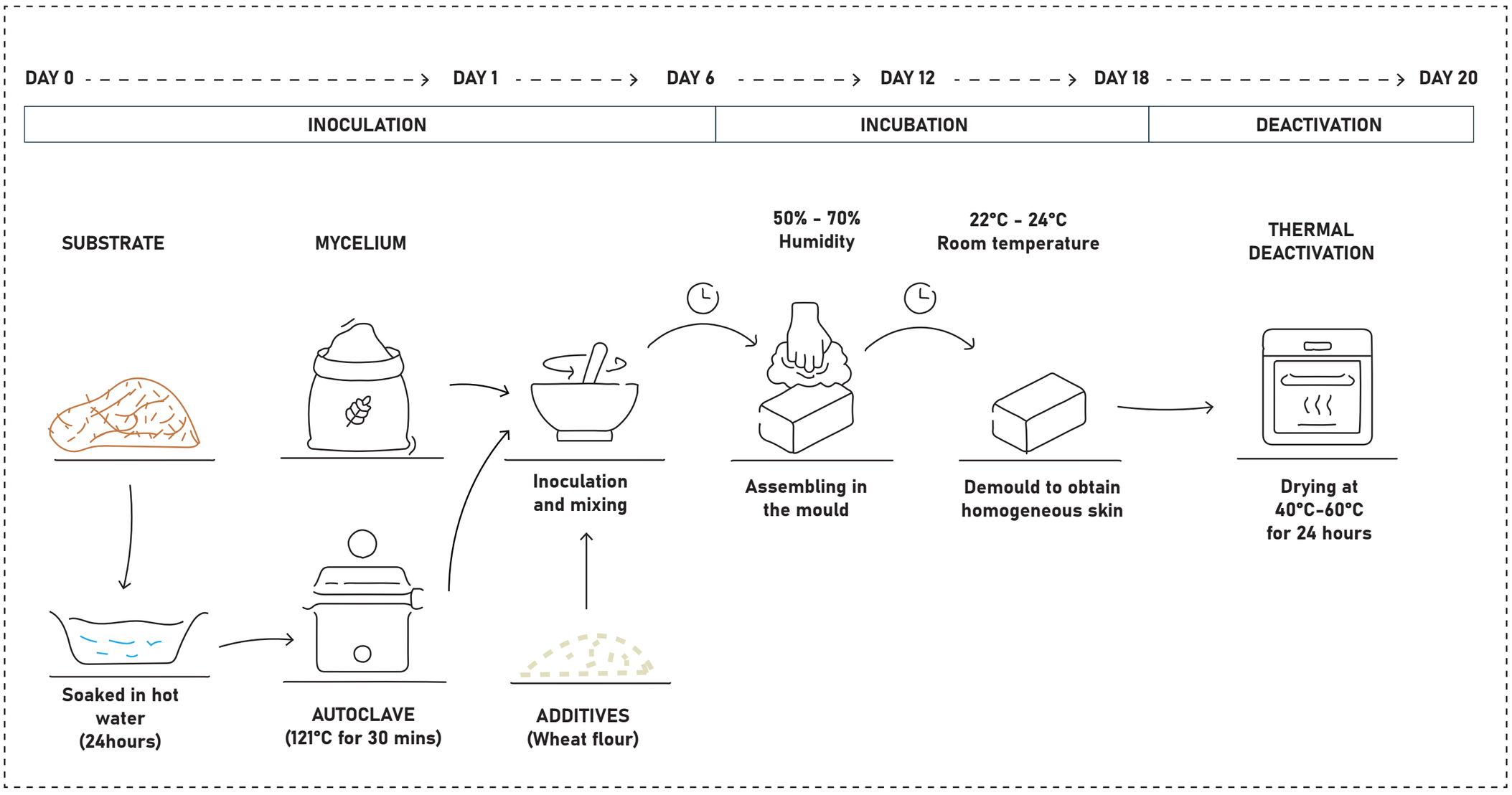
bamboo



mycelium

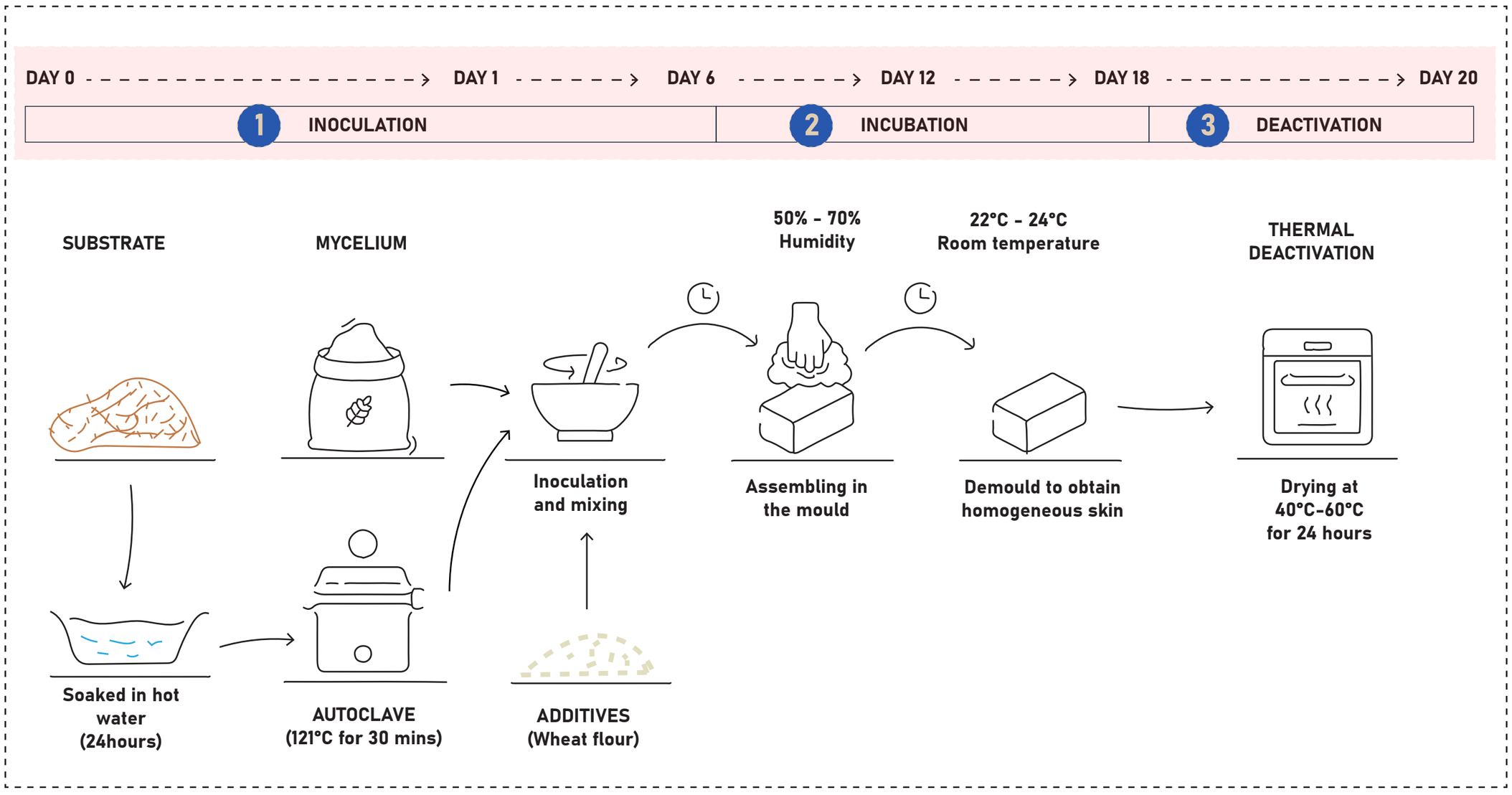


What is an MBC? How does one create it?



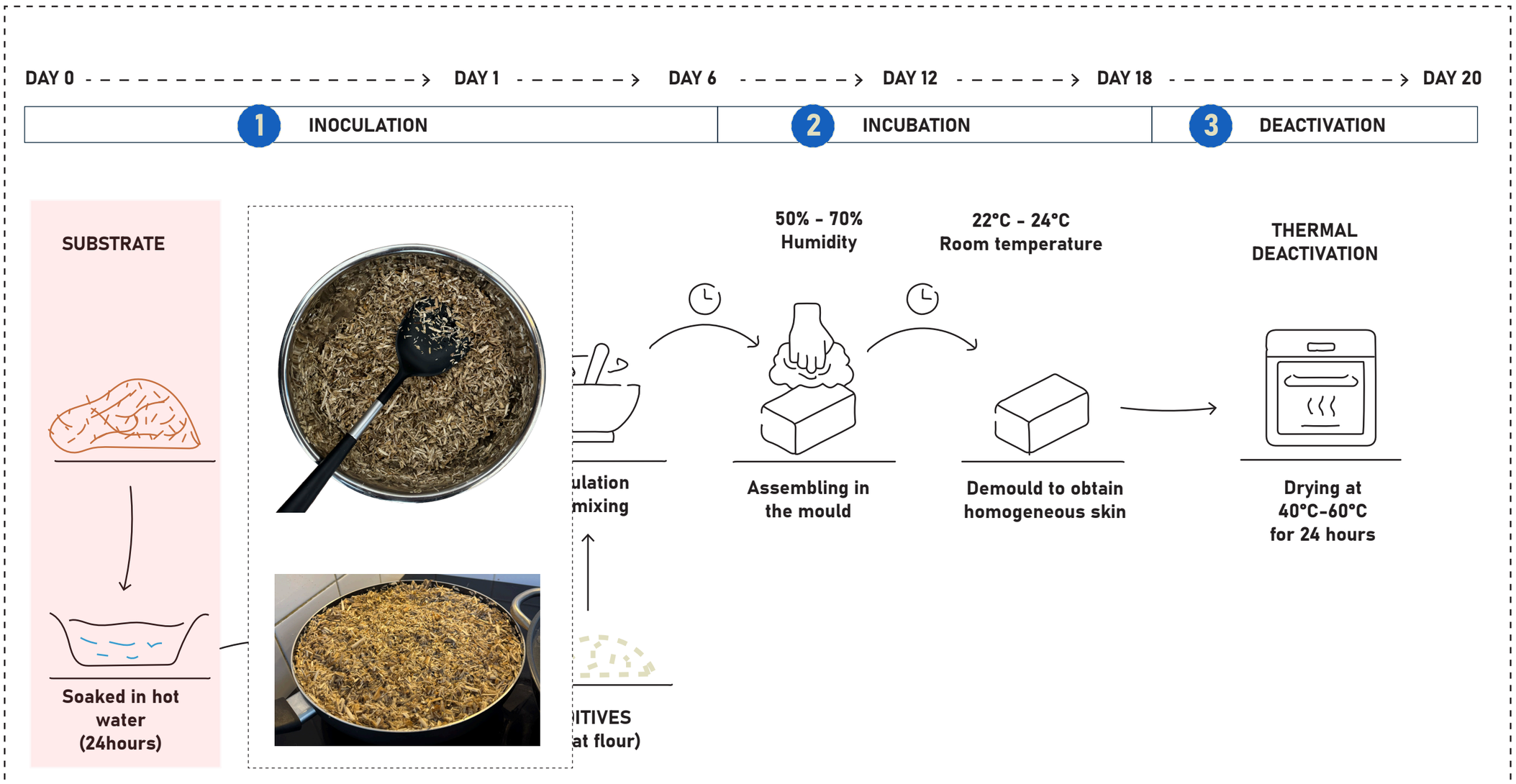
production recipe

What is an MBC? How does one create it?



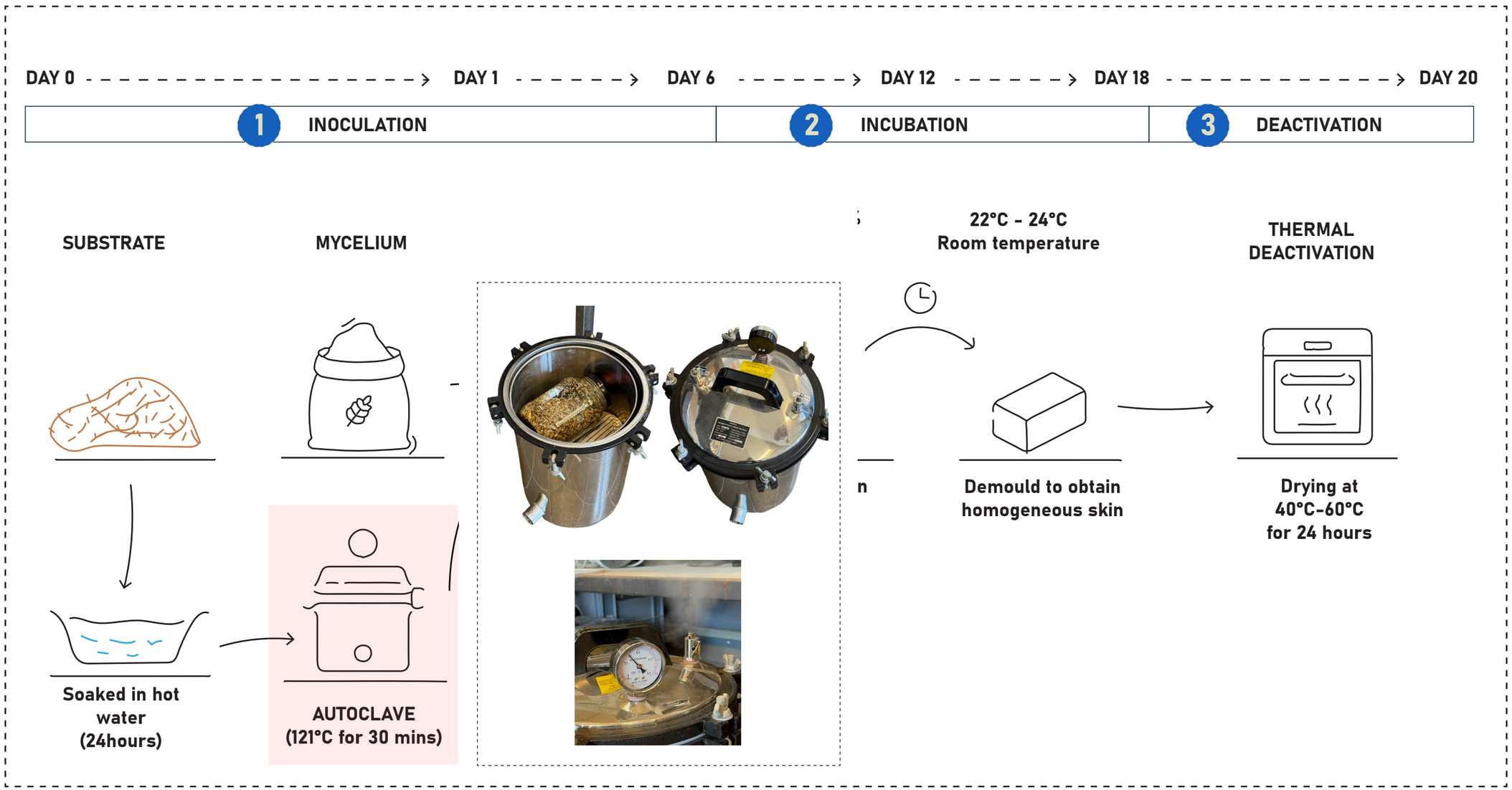
production recipe

What is an MBC? How does one create it?



production recipe

What is an MBC? How does one create it?



What is an MBC? How does one create it?

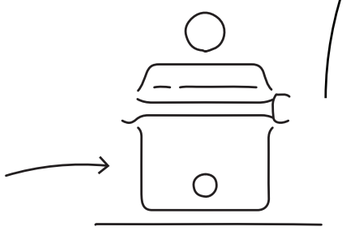
production recipe

DAY 0 → DAY 1 → DAY 6 → DAY 12 → DAY 18 → DAY 20

1 INOCULATION | 2 INCUBATION | 3 DEACTIVATION

SUBSTRATE

Soaked in hot water (24hours)



AUTOCLAVE (121°C for 30 mins)

MYCELIUM

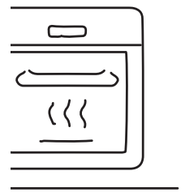
STV

Liquid culture

rotterzwam more than mushrooms Certified B Corporation

Grain spawn

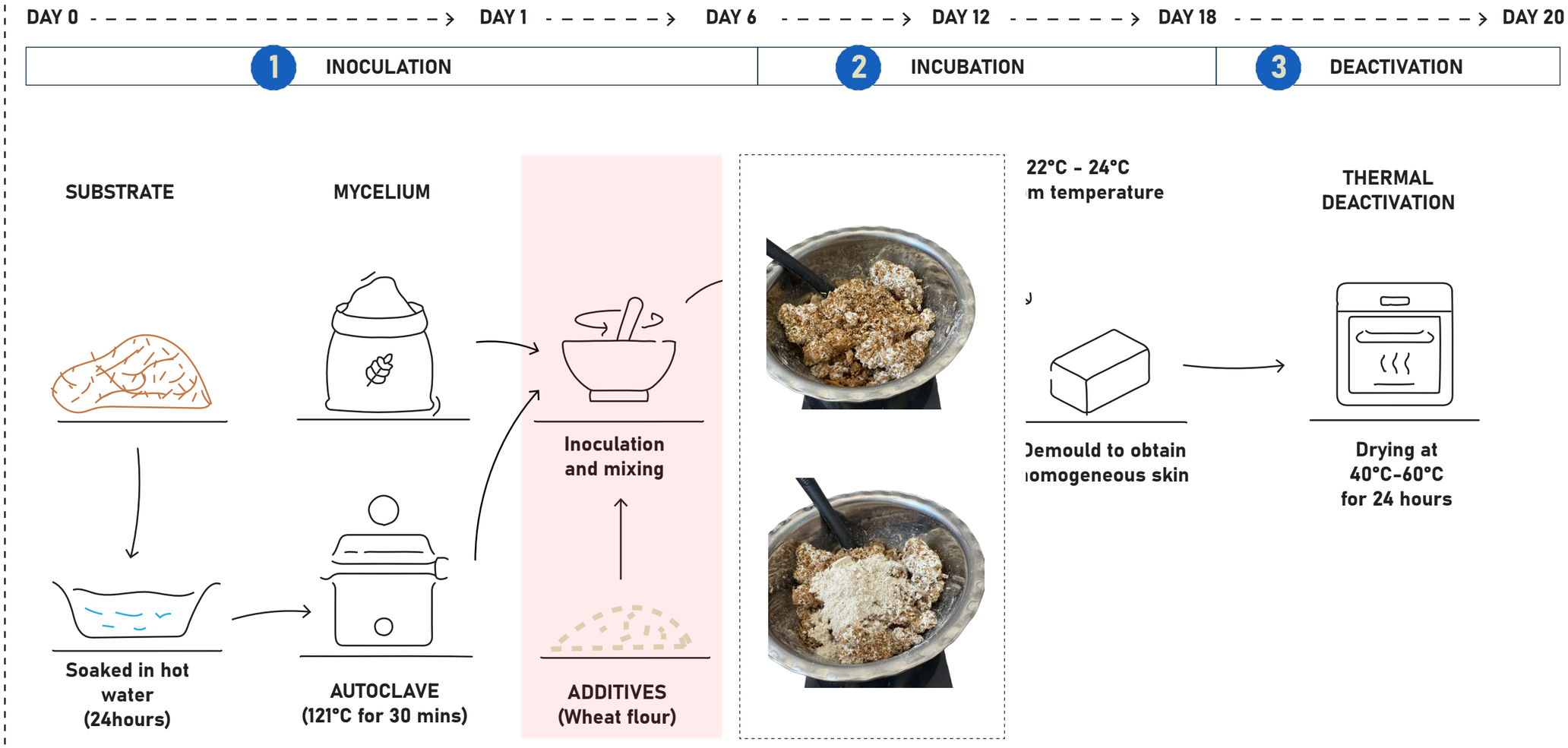
THERMAL DEACTIVATION



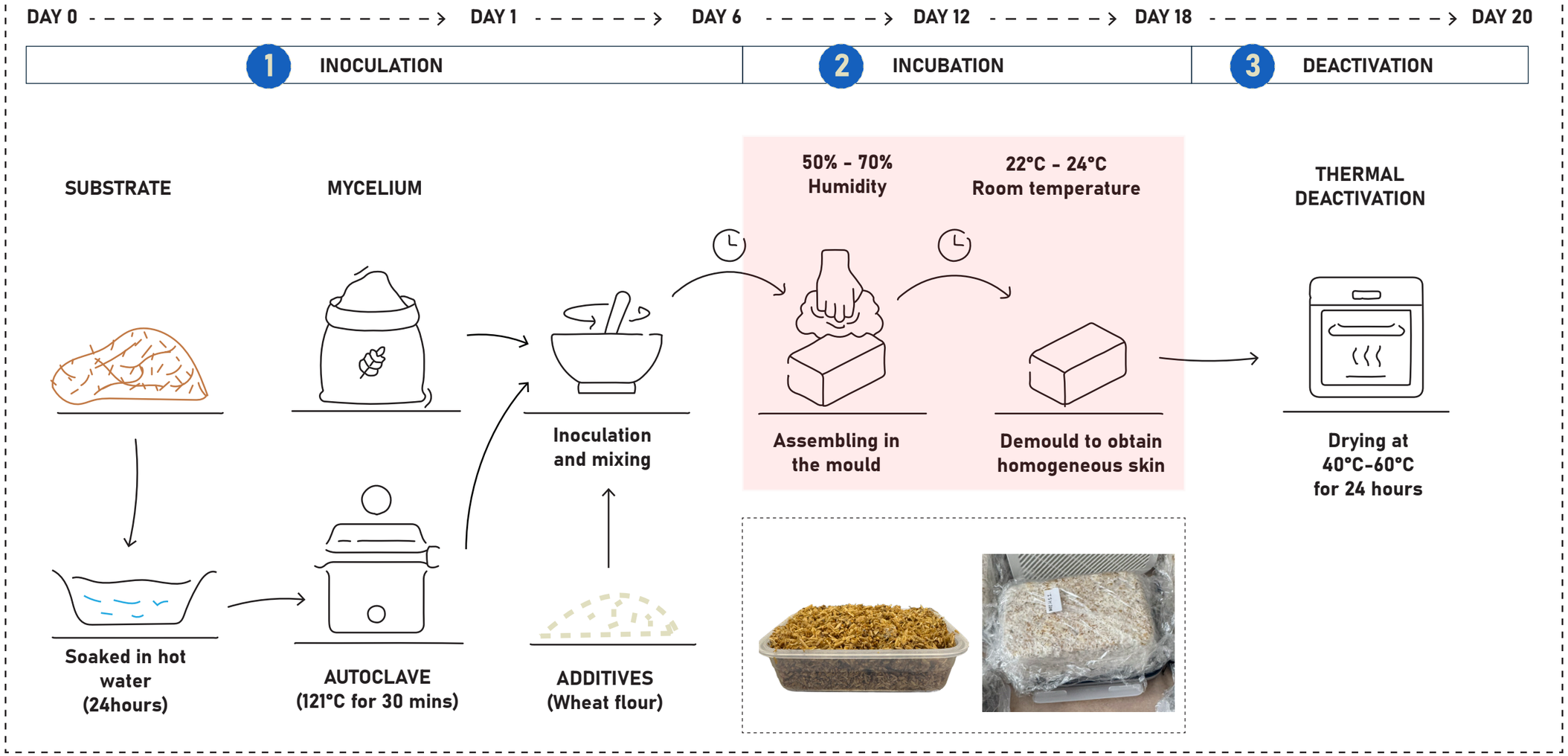
Drying at 40°C-60°C for 24 hours

What is an MBC? How does one create it?

production recipe



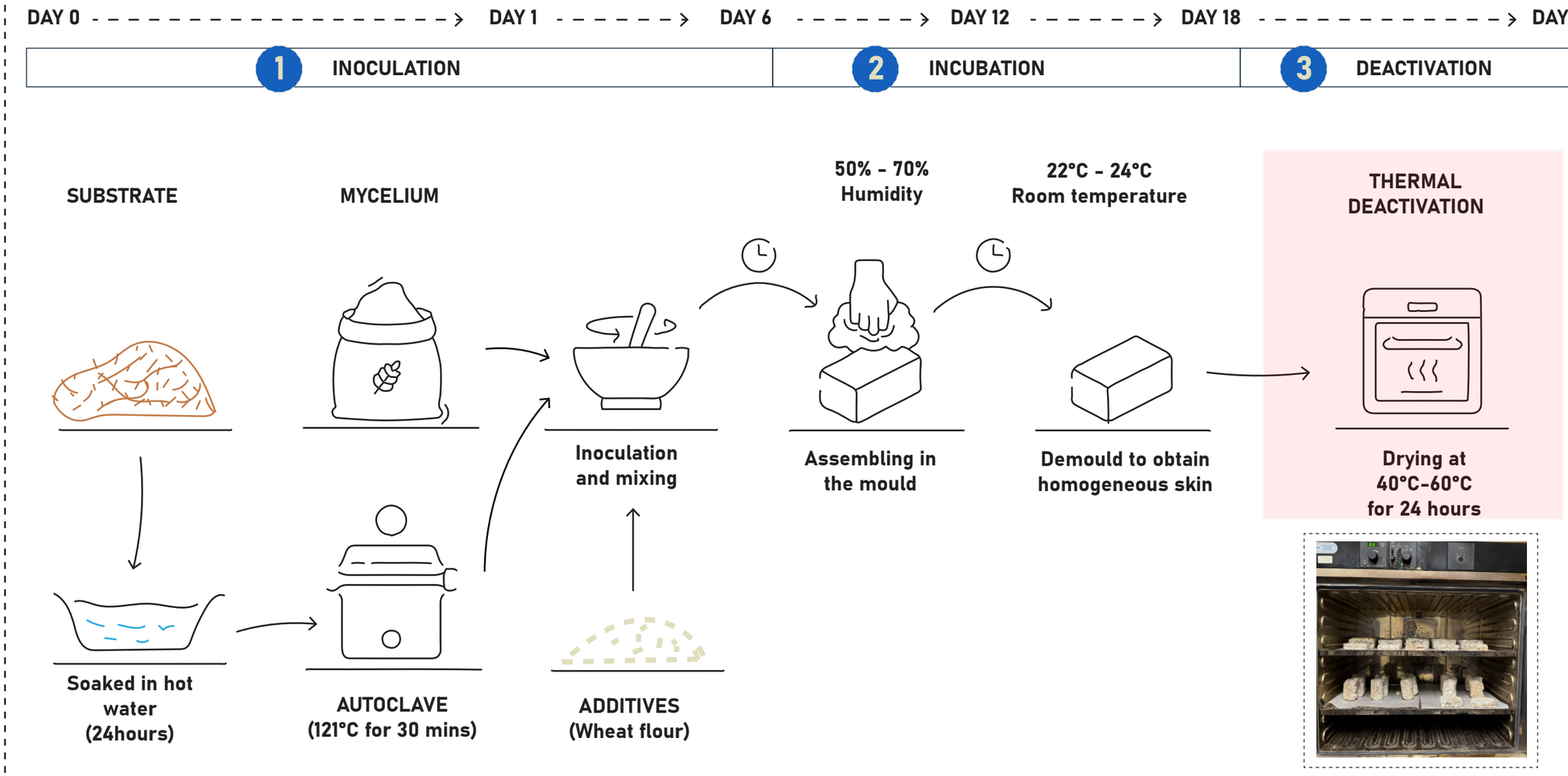
What is an MBC? How does one create it?



production recipe

What is an MBC? How does one create it?

production recipe



Current Market Applications

MYCEEN: Insulation Panels

Thermal conductivity λ	0.037 W/mK
Fire behaviour (EN 13501-1)	D, s2, d0
Bulk density (EN 13171)	100 kg/m³
Water vapour diffusion resistance (EN 13171)	2,3
Compressive strength at 10% compression (EN 13171)	0.07 - 0.17 N/mm²
Water absorption	1 kg/m²

Source : Myceen (https://myceen.com/building-materials)

MOGU: Acoustic Panels

Are Mogu Acoustic panels fire proof?

Our acoustic panels are certified for a striking B-s1-d0 fire rating, thanks to an exclusive and eco-friendly fire retardant finishing. The finishing is non-bromurated, non-halogen, antimony and heavy-metal free. We are also happy to provide Mogu Acoustic panels in their natural, non-coated aesthetics, achieving a D-s1-d0 class.

Source : Mogu (https://mogu.bio/)

Current Market Applications

MYCEEN: Insulation Panels

Within the range of conventional insulation material like EPS: 0.031 to 0.038 W/mK

thermal conductivity

Thermal conductivity λ	0.037 W/mK
Fire behaviour (EN 13501-1)	D, s2, d0
Bulk density (EN 13171)	100 kg/m³
Water vapour diffusion resistance (EN 13171)	2,3
Compressive strength at 10% compression (EN 13171)	0.07 - 0.17 N/mm²
Water absorption	1 kg/m²

Source : Myceen (https://myceen.com/building-materials)

MOGU: Acoustic Panels

Are Mogu Acoustic panels fire proof?

Our acoustic panels are certified for a striking B-s1-d0 fire rating, thanks to an exclusive and eco-friendly fire retardant finishing. The finishing is non-bromurated, non-halogen, antimony and heavy-metal free. We are also happy to provide Mogu Acoustic panels in their natural, non-coated aesthetics, achieving a D-s1-d0 class.

Limited combustibility; Mid-rise buildings

fire rating

Source : Mogu (https://mogu.bio/)

Context

Material Property	Mycelium-based Materials	Polymer Materials	Gypsum-based Materials	Cement Material
Density (kg/m³)	110 ± 0.01 to 330 ± 0.05	22 to 30	417–945	1800–1950
Cost ($/kg)	0.07–0.17	2.1–2.3	1.4–11	-
Cost ($/m³)	19.05	-	-	942.86
Compressive strength (kPa)	360 ± 5 to 520 ± 8	69–400	60–550	3450
Water absorption (%)	200	6.9	52	12
Recyclability	Fully degradable	Decades, century	Years, decades	None
Raw materials	Mycelium and organic wastes or substrates	Polymers and natural gases	Adhesives, sawdust, and chips	Cement and sand
Manufacturing process	Moulding and growing	Polymerisation and expansion	Lathing, pressing, resin infusion, and milling	Mixing, moulding, and curing

Source: Alemu et al. (2022)

Context

Material Property	Mycelium-based Materials	Polymer Materials	Gypsum-based Materials	Cement Material
Density (kg/m³)	110 ± 0.01 to 330 ± 0.05	22 to 30	417–945	1800–1950
Cost ($/kg)	0.07–0.17	2.1–2.3	1.4–11	-
Cost ($/m³)	19.05	-	-	942.86
Compressive strength (kPa)	360 ± 5 to 520 ± 8	69–400	60–550	3450
Water absorption (%)	200	6.9	52	12
Recyclability	Fully degradable	Decades, century	Years, decades	None
Raw materials	Mycelium and organic wastes or substrates	Polymers and natural gases	Adhesives, sawdust, and chips	Cement and sand
Manufacturing process	Moulding and growing	Polymerisation and expansion	Lathing, pressing, resin infusion, and milling	Mixing, moulding, and curing

Almost 50 times cheaper than concrete

Easy recyclability; Natural raw materials

Source: Alemu et al. (2022)

Context

Material Property	Mycelium-based Materials	Polymer Materials	Gypsum-based Materials	Cement Material
Density (kg/m³)	110 ± 0.01 to 330 ± 0.05	22 to 30	417–945	1800–1950
Cost ($/kg)	0.07–0.17	2.1–2.3	1.4–11	-
Cost ($/m³)	19.05	-	-	942.86
Compressive strength (kPa)	360 ± 5 to 520 ± 8	69–400	60–550	3450
Water absorption (%)	200	6.9	52	12
Recyclability	Fully degradable	Decades, century	Years, decades	None
Raw materials	Mycelium and organic wastes or substrates	Polymers and natural gases	Adhesives, sawdust, and chips	Cement and sand
Manufacturing process	Moulding and growing	Polymerisation and expansion	Lathing, pressing, resin infusion, and milling	Mixing, moulding, and curing

6 times higher than MBCs

Source: Alemu et al. (2022)

Research Question

How can mycelium bio-composites (MBCs) be engineered using woven bamboo fibres as reinforcement to achieve increased compressive mechanical properties for load-bearing applications?

Research Question

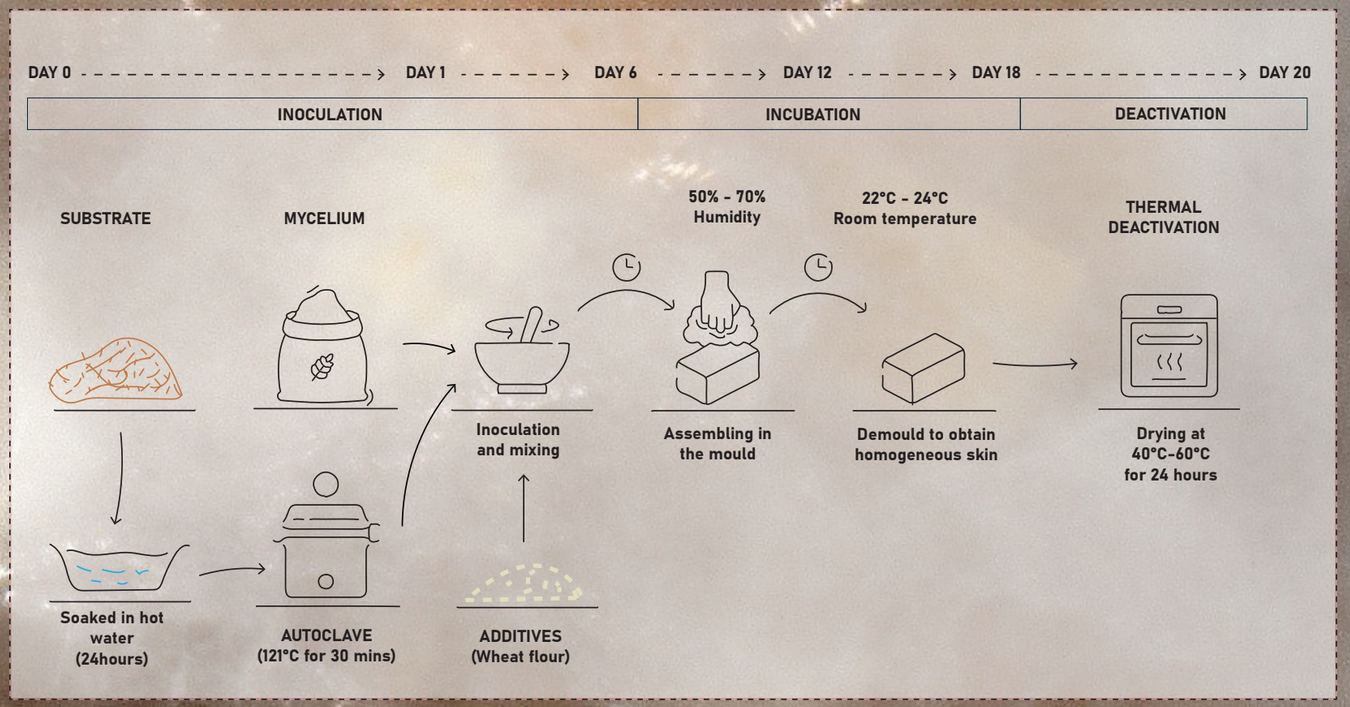
MBCs: Material Composition

How can **mycelium bio-composites (MBCs)** be engineered using **woven bamboo fibres as reinforcement** to **achieve increased compressive mechanical properties** for **load-bearing applications**?

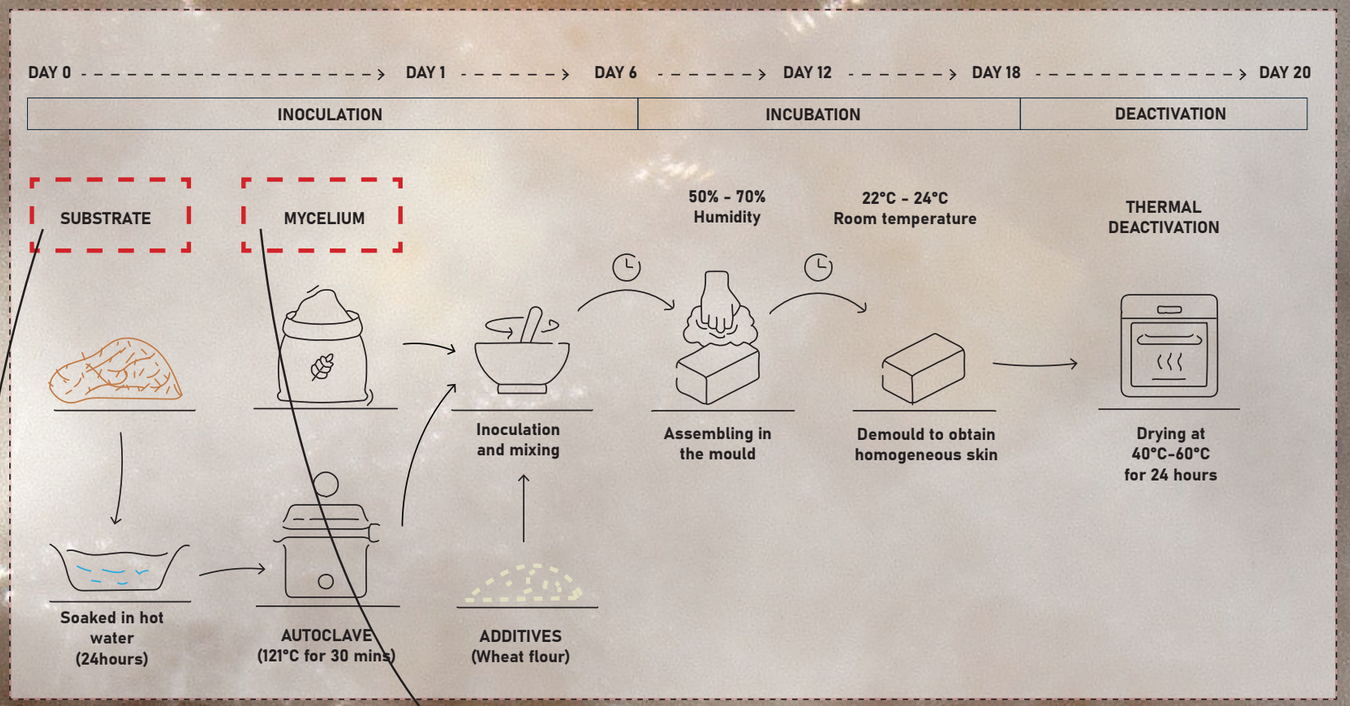
Woven Bamboo Reinforcement

Scaffold Reinforcement

What is the Material composition?



What is the Material composition?



Substrate type

Mycelium strain type

Influence on Material properties

material composition

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

Influence on Material properties

material composition

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

Wide range from 90 kPa to 3000 kPa

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

Influence of Mycelium strain type

material composition

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

Influence of Mycelium strain type

material composition

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

Commonly known as Oyster Mushroom

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

Influence of Mycelium strain type

material composition

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

Influence of Mycelium strain type

material composition

Sawdust and Hemp commonly used

Comparison of Mechanical Properties

Fiber Substrate	Type of Mycelium	Density (kg/m3)	Flexural strength (kPa)	Compre--ssion (kPa)	Citation Reference
Wood chips, hemp hurd	Coriolus Versicolor	260	N/A	93	Lelivelt et al., 2015
Wood chips and hemp fiber	Pleurotus ostreatus	130	347	452	Etinosa 2017 Thesis
Wood veneer and hemp hurds	Ganoderma lucidum	145	160	1200	Özdemir et al., 2022
Hemp hurds	Pleurotus Ostreatus	N/A	N/A	700	Etinosa et al., 2023
Hemp	Trametes versicolor	99	N/A	510	Elsacker et al., 2019
Sawdust 90% and wheat 10%	Pleurotus ostreatus	493	N/A	1380	Ghazvinian et al., 2019
Sawdust and wheat bran	Lentinus velutinus	N/A	N/A	1280	Bruscato et al., 2019
Cotton stalk, wheat bran	Pleurotus ostreatus	N/A	N/A	508	Gou et al., 2021
Beech Sawdust	Pleurotus ostreatus	260	110	2490	Vašatko et al., 2022
Straw	Pleurotus ostreatus	132	370	210	Ghazvinian et al., 2022
Rice straw	Lentinus squarrosulus	N/A	N/A	540	Ly et al., 2022
Bamboo	Pleurotus ostreatus spawn	N/A	N/A	500	Soh et al., 2023
Bamboo	Trimitic fungi species	180	450	190	Bagheriehnajjar et al., 2023
Coffee grounds with pineapple fiber	Pleurotus Ostreatus	360	200	2920	Kohphaisansombat et al., 2023

All examples: Unreinforced composites

Source : Voutetaki & Mpalaskas, 2024

What can make it stronger?

Scaffold reinforcement

Structural form

Controlled geometry

State of the art- Structural Prototypologies

Project / Year of completion	Location	Type	Structure	Fungus	Substrate	Post -treatment	Creators
HY-FI (2014)	Outside	Brick	Wood, Steel	*Ganoderma lucidum*	Corn stalks	Heat treated	The Living Studio
SHELL MYCELIUM (2017)	Outside	Panel	Wood, Steel	Information not available	Coir pith	Naturally dried	Studio Beetles 3.3 Yassin Arredia Design
MYCOTREE (2017)	Inside	Block	Bamboo, Steel	*Pleurotus ostreatus*	Sugar cane, Cassava root	Heat treated	Sustainable Construction KIT Karlsruhe Block Research Group ETH Zürich
MONOLITO MICELIO (2020)	Outside	Monolith	Wood, Steel	*Ganoderma lucidum*	Hemp	Naturally dried	Georgia Institute of Technology School of Architecture
GROWING PAVILION (2020)	Outside	Panel	Wood	*Ganoderma lingzhi*	Hemp, Cattail, Mace	Heat treated, Weather resist-ant biocoating	Company New Heroes E. Klarenbeek
MY-CO SPACE (2021)	Outside	Panel	Wood, Steel	*Fomes fomentarius*	Hemp	Heat treated, Weather resist-ant coating	MY-CO-X Collective

scaffold reinforcement

Source : Almpani-Lekka et al., 2021

State of the art- Structural Prototypologies

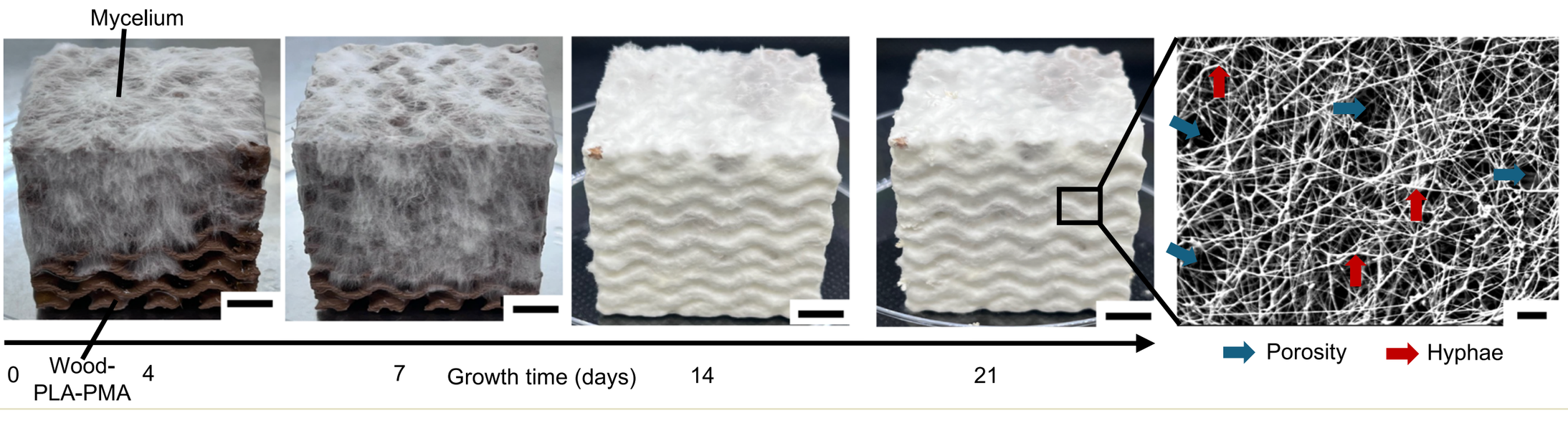
Project / Year of completion	Location	Type	Structure	Fungus	Substrate	Post -treatment	Creators
HY-FI (2014)	Outside	Brick	Wood, Steel	*Ganoderma lucidum*	Corn stalks	Heat treated	The Living Studio
SHELL MYCELIUM (2017)	Outside	Panel	Wood, Steel	Information not available	Coir pith	Naturally dried	Studio Beetles 3.3 Yassin Arredia Design
MYCOTREE (2017)	Inside	Block	Bamboo, Steel	*Pleurotus ostreatus*	Sugar cane, Cassava root	Heat treated	Sustainable Construction KIT Karlsruhe Block Research Group ETH Zürich
MONOLITO MICELIO (2020)	Outside	Monolith	Wood, Steel	*Ganoderma lucidum*	Hemp	Naturally dried	Georgia Institute of Technology School of Architecture
GROWING PAVILION (2020)	Outside	Panel	Wood	*Ganoderma lingzhi*	Hemp, Cattail, Mace	Heat treated, Weather resist-ant biocoating	Company New Heroes E. Klarenbeek
MY-CO SPACE (2021)	Outside	Panel	Wood, Steel	*Fomes fomentarius*	Hemp	Heat treated, Weather resist-ant coating	MY-CO-X Collective

Reliance on base Framework for structure

scaffold reinforcement

Source : Almpani-Lekka et al., 2021

Scaffold design affecting porosity



scaffold reinforcement

Source : Sharma & Le Ferrand, 2025

Scaffold design affecting porosity

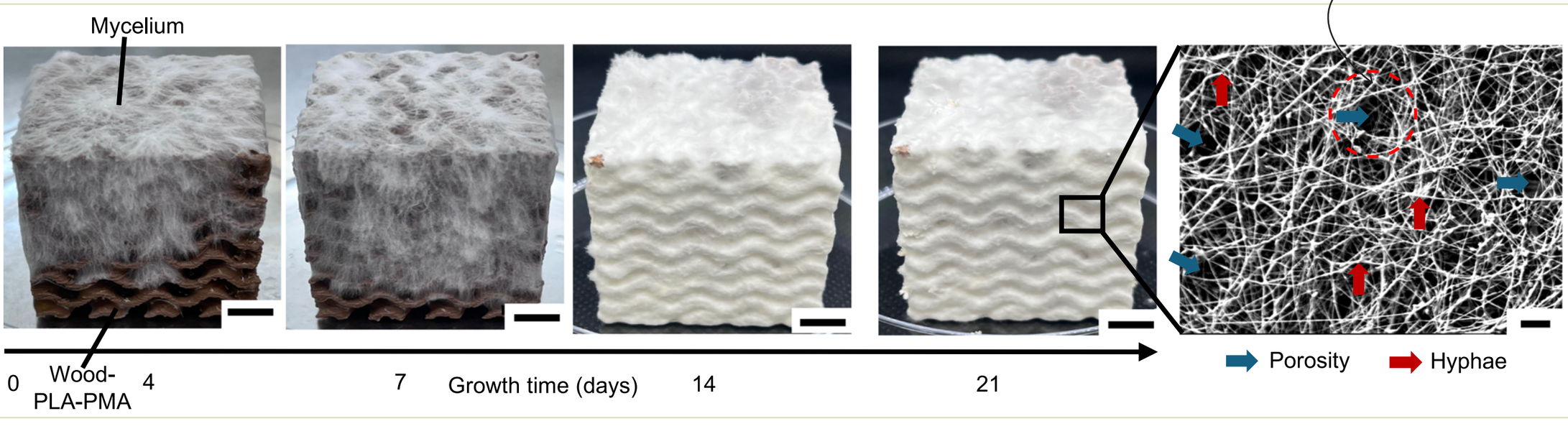
scaffold reinforcement

Source : Sharma & Le Ferrand, 2025

Scaffold design affecting porosity

porosity

Porosity: Space/Air pockets between the growth



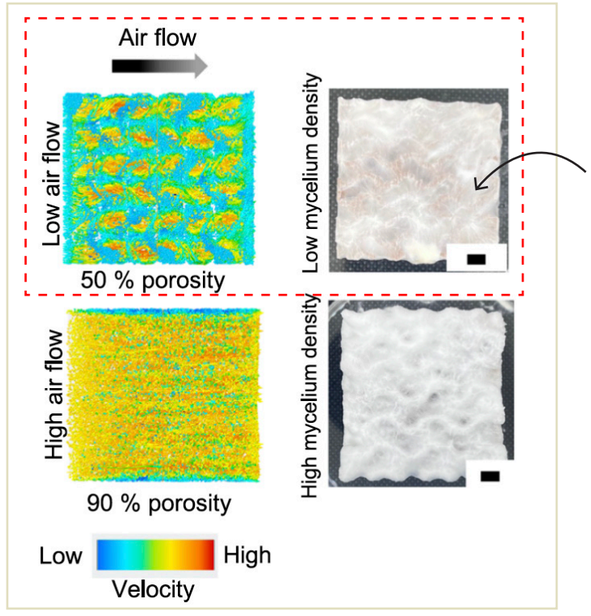
Resultant Mechanical Characterisations :

The best-performing case was the cell-size grade scaffold with **50% porosity** (CG50_my)

This design achieved:
Yield strength (σy): 7.29 ± 0.65 MPa;

Elastic modulus (E): 257 ± 18.8 MPa; Peak strength (σp): 15.77 ± 1.08 MPa ; Specific energy absorption (SEA): 8.79 ± 0.77 kJ/kg

Strongest MBC so far!



Effective porosity of 50%

Source : Sharma & Le Ferrand, 2025

scaffold reinforcement

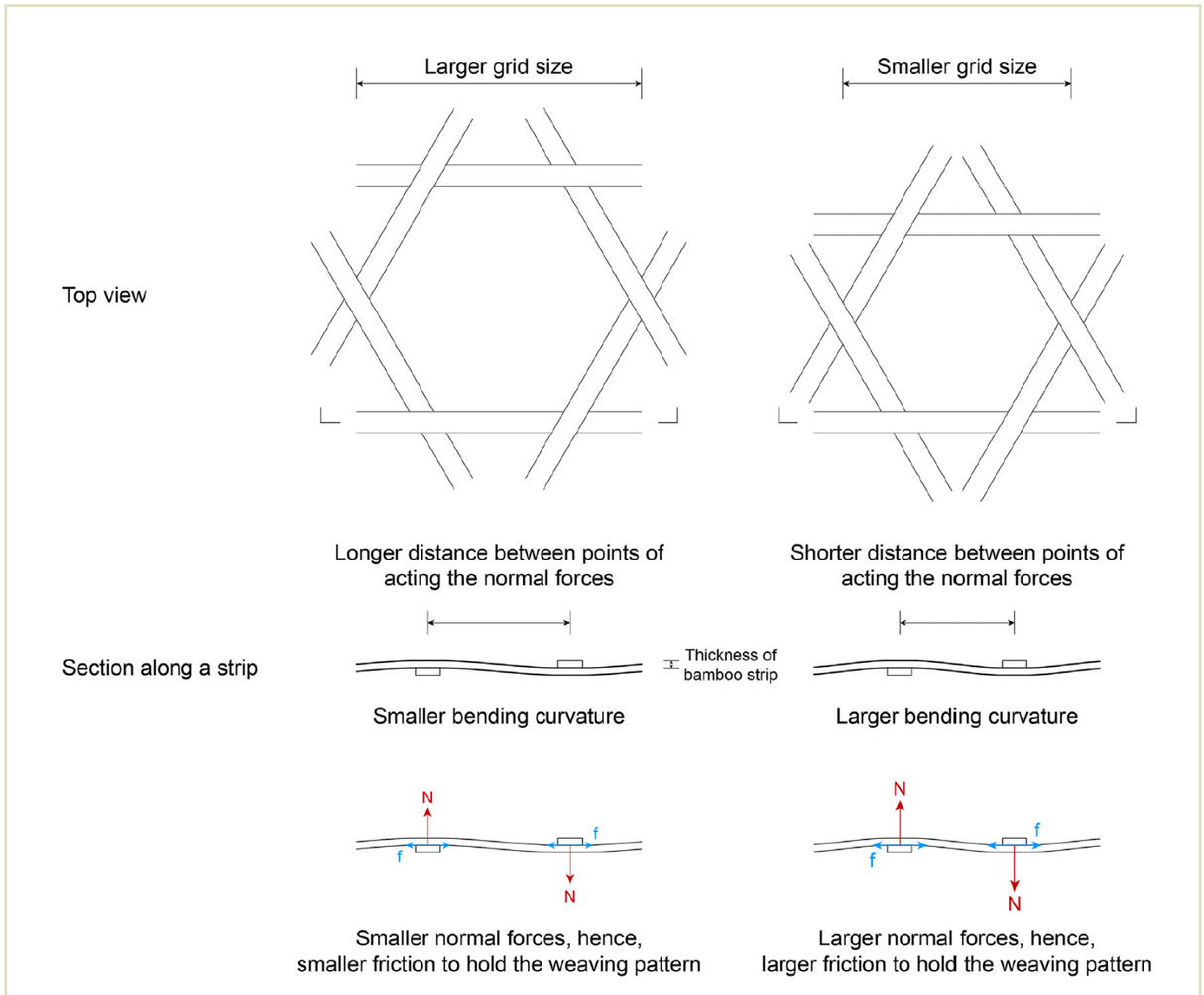
Why does Bamboo weaving fit best for the scaffold reinforcement?

Stiffness

Cellulose based fibre

Uniformly controlled geometry

Bamboo strip: Weaving strategies

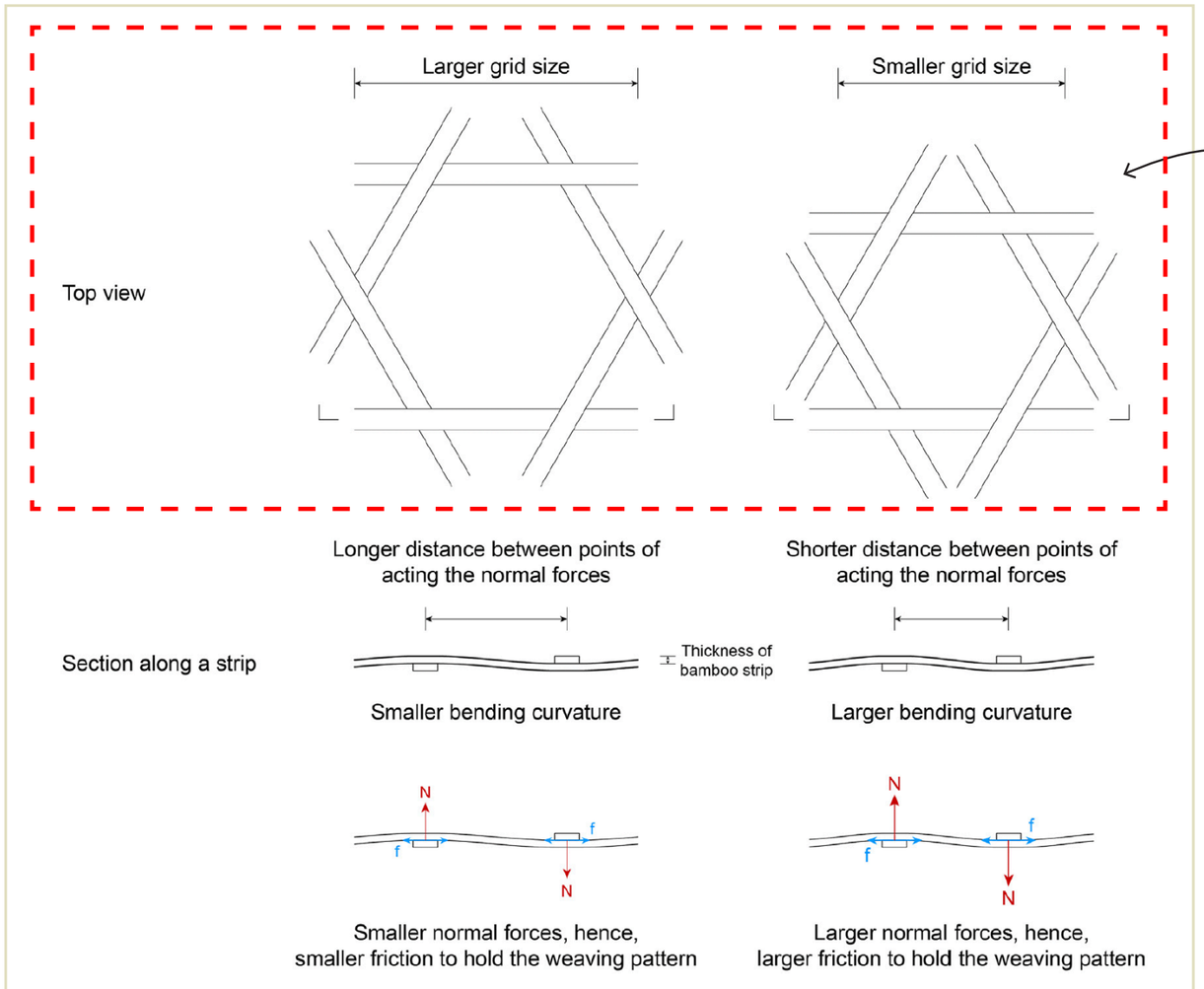


Bamboo weaving: Thickness of the strip & grid size affecting the stiffness

bamboo reinforcement

Source : Hebbar, 2015

Bamboo: Weaving strategies

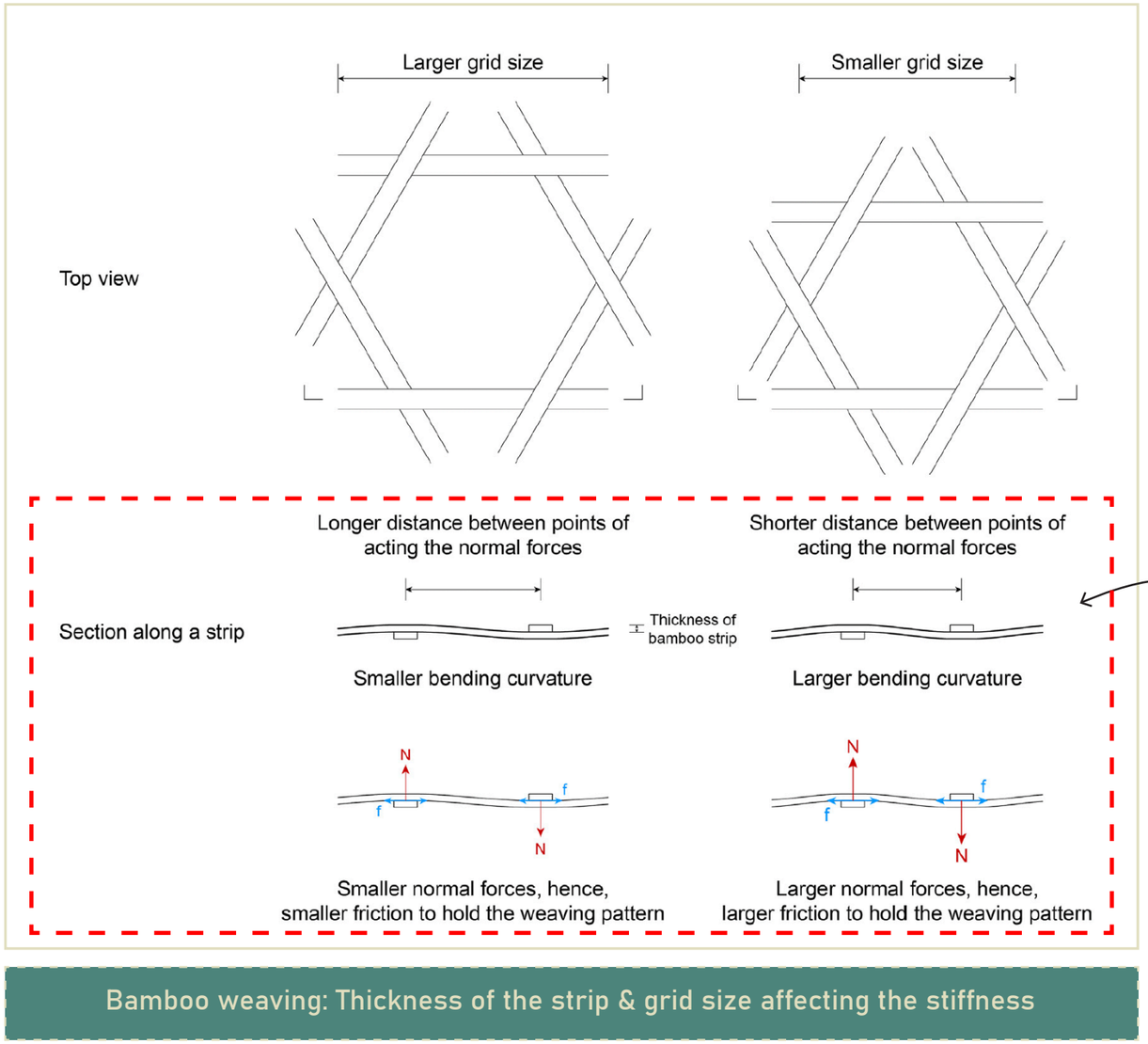


Bamboo weaving: Thickness of the strip & grid size affecting the stiffness

bamboo reinforcement

Source : Hebbar, 2015

Bamboo: Weaving strategies



Bamboo weaving: Thickness of the strip & grid size affecting the stiffness

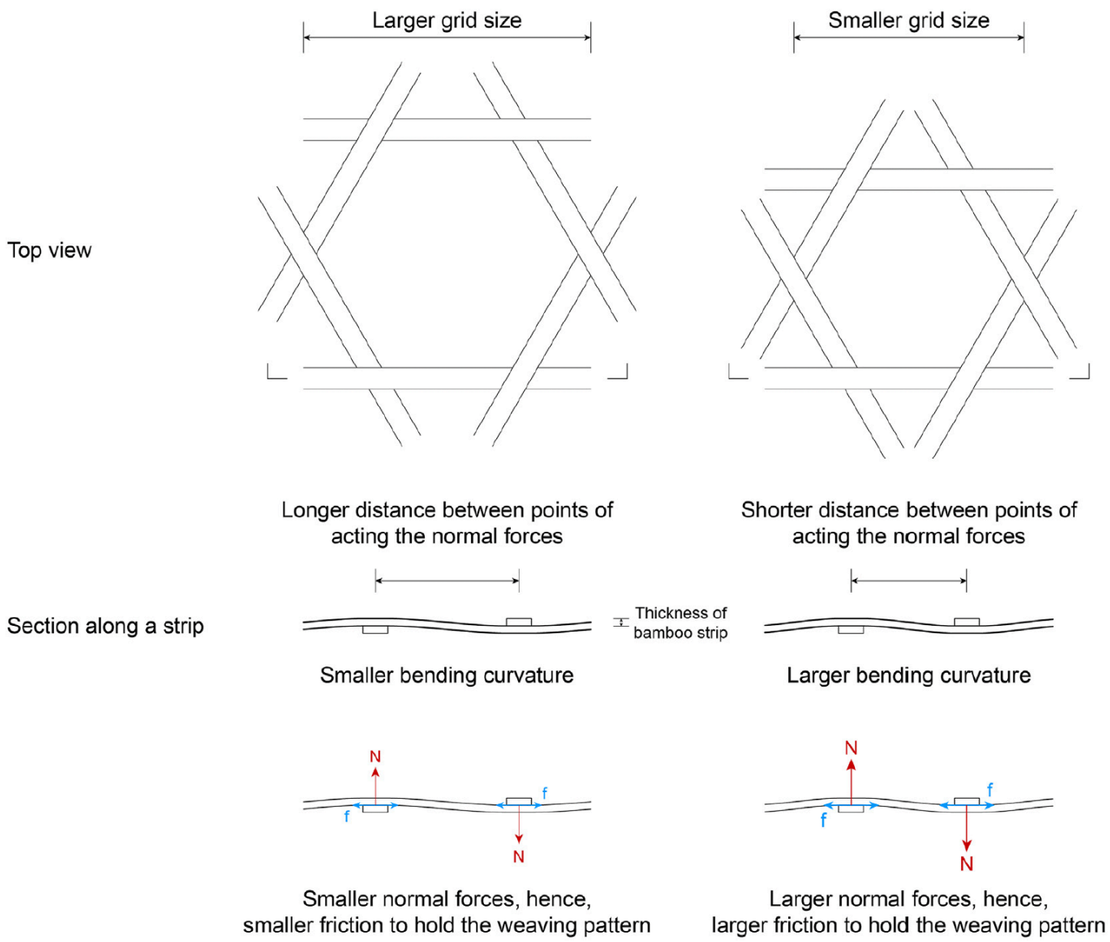
Controlled Porosity:
Space between the strips

Controlled Stiffness:
with overlapping thicknes of the strip

bamboo reinforcement

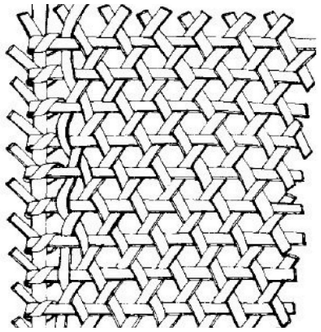
Source : Hebbar, 2015

Bamboo: Weaving strategies



Bamboo weaving: Thickness of the strip & grid size affecting the stiffness

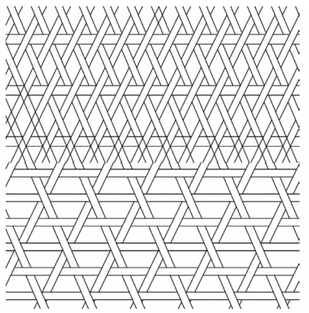
1



8mm wide, 2mm thick

2

Stiffer structure

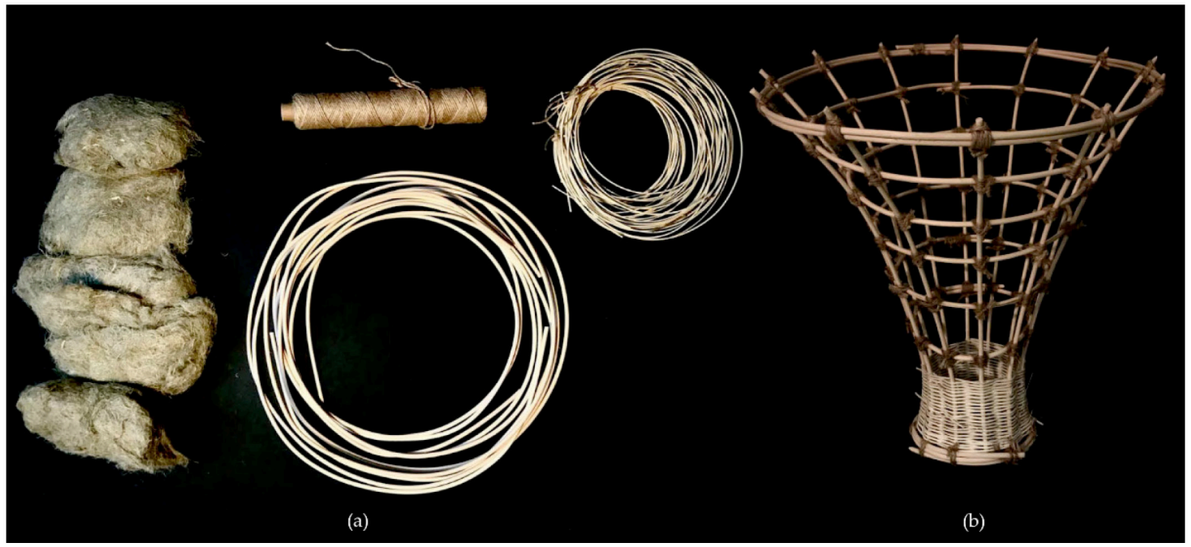


3mm wide, 1,5mm thick

bamboo reinforcement

Source : Hebbar, 2015

MycoMerge: Woven Reinforcement

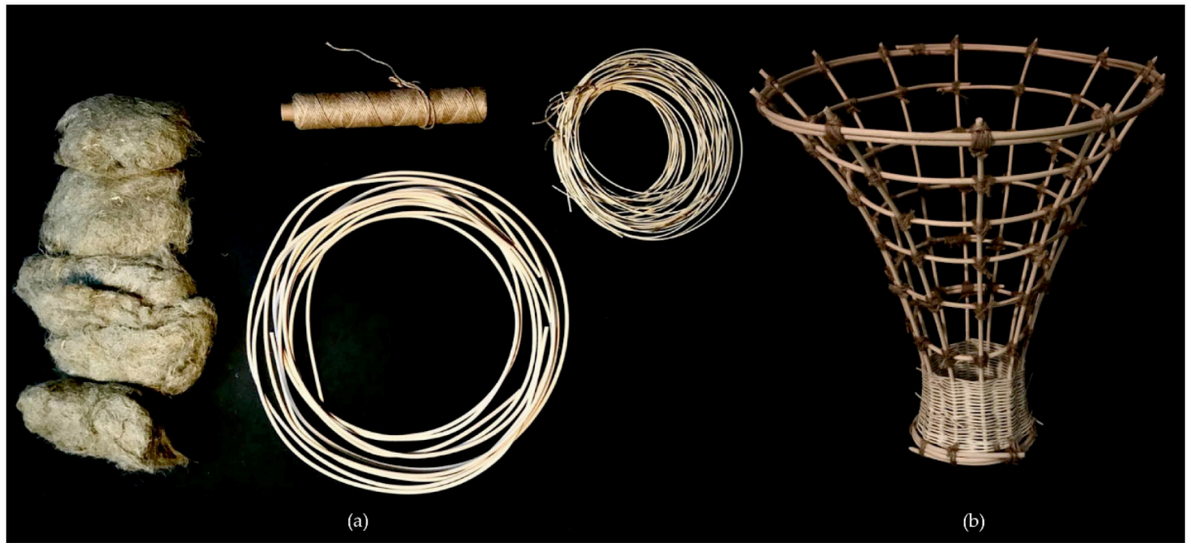


Material overview : hemp fibres, rattan rods, jute fabric, assembled frame

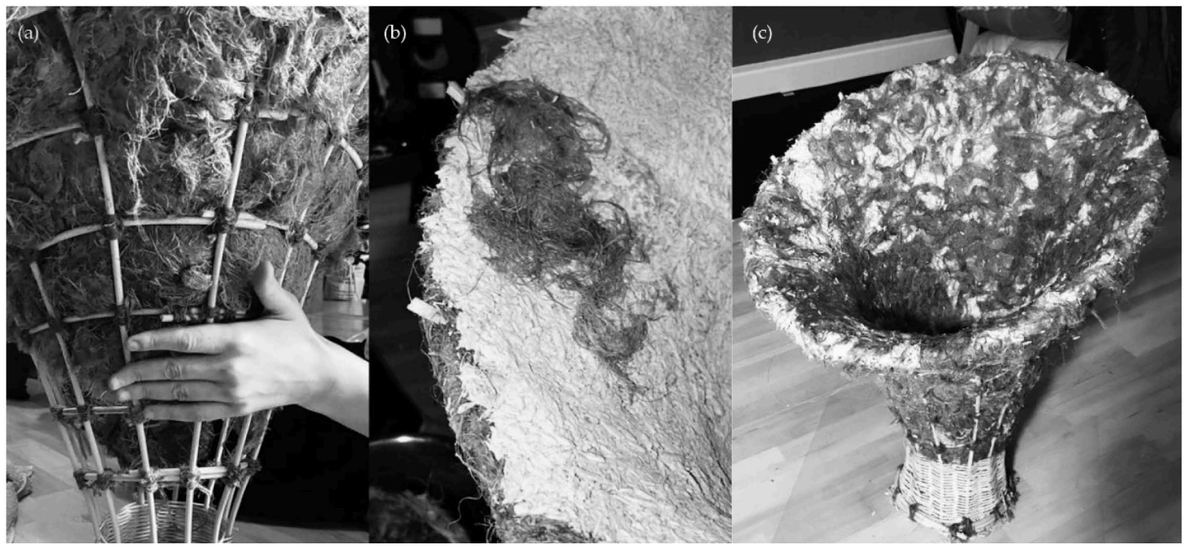
bamboo reinforcement

Source : Nguyen et al., 2022

MycoMerge: Woven Reinforcement



Material overview : hemp fibres, rattan rods, jute fabric, assembled frame

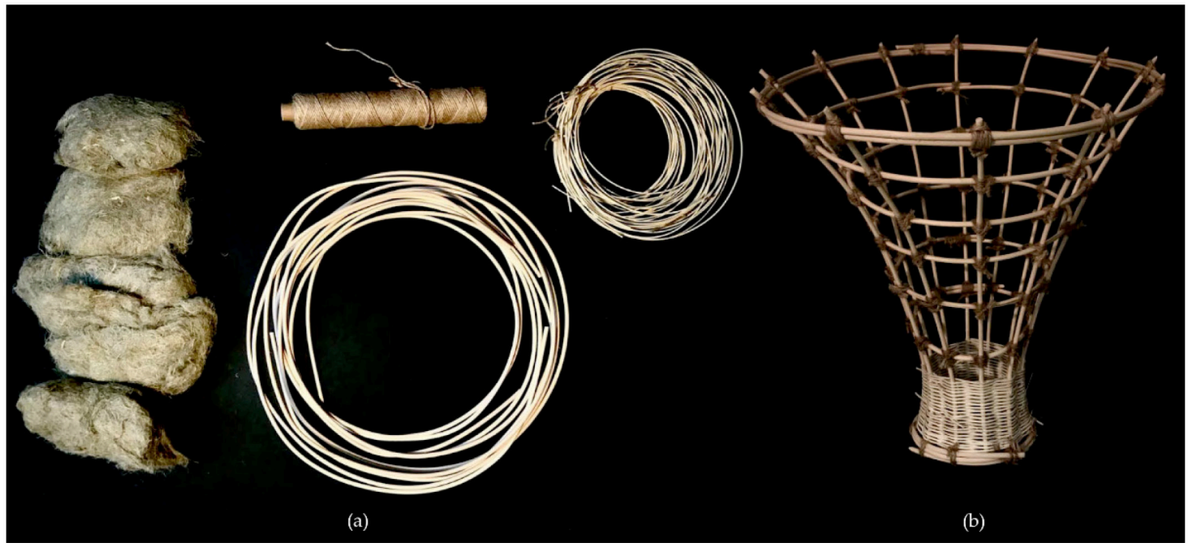


Assembly : placing of fibres, substrate + additional layers, assembled stool

bamboo reinforcement

Source : Nguyen et al., 2022

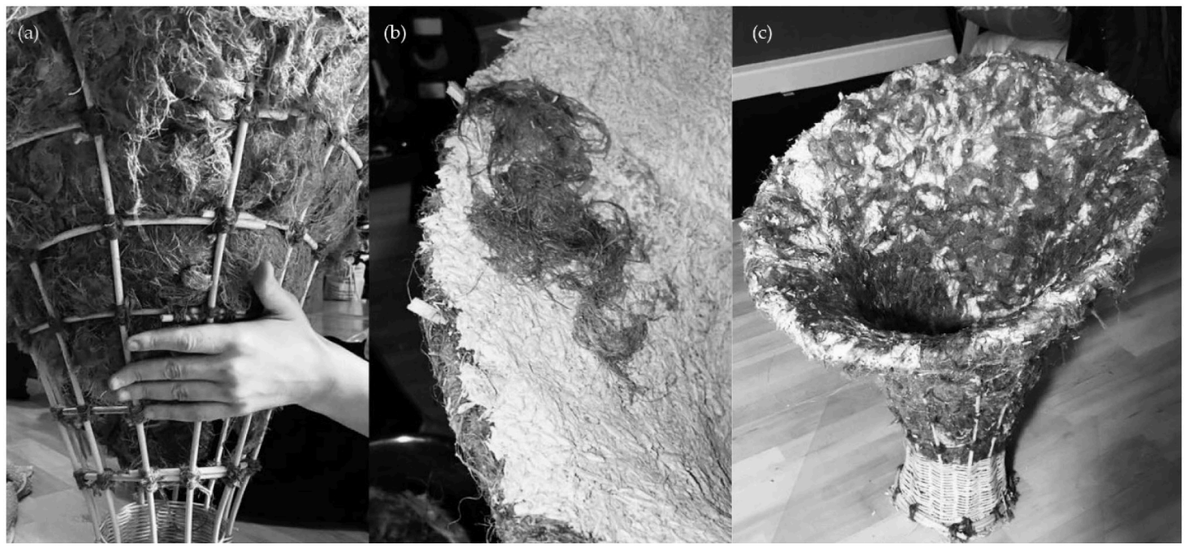
MycoMerge: Woven Reinforcement



Material overview : hemp fibres, rattan rods, jute fabric, assembled frame

Final prototype

bamboo reinforcement

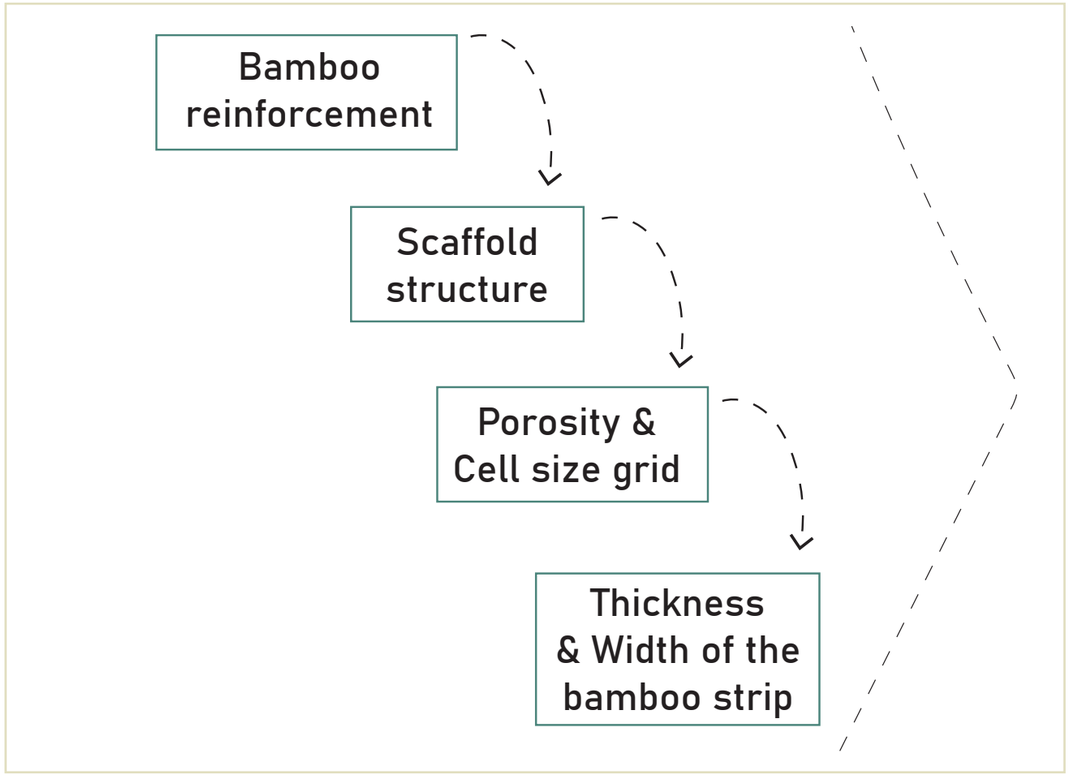


Assembly : placing of fibres, substrate + additional layers, assembled stool

mass of 3.7 kg ; capable of supporting 20 times its own weight

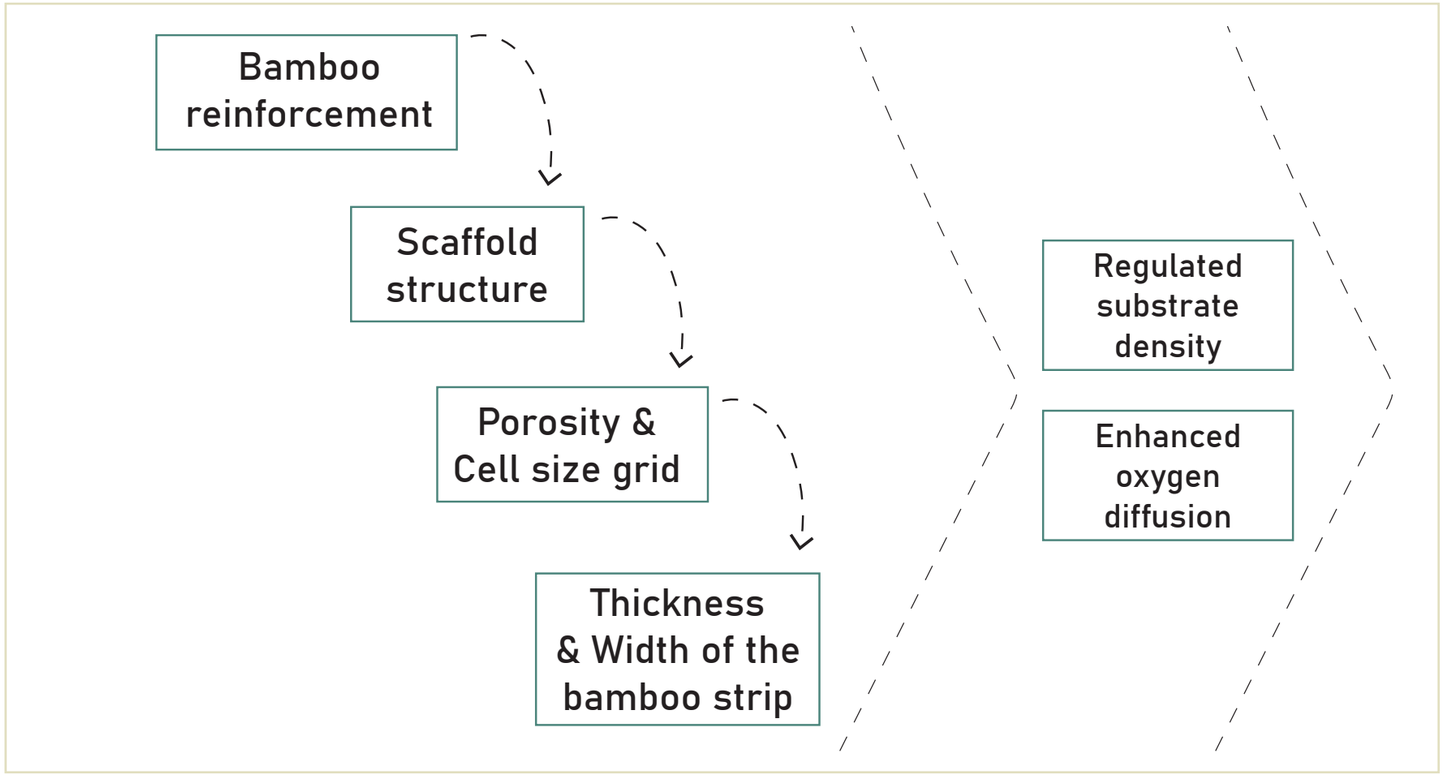
Source : Nguyen et al., 2022

Variables dependency on dense mycelial network



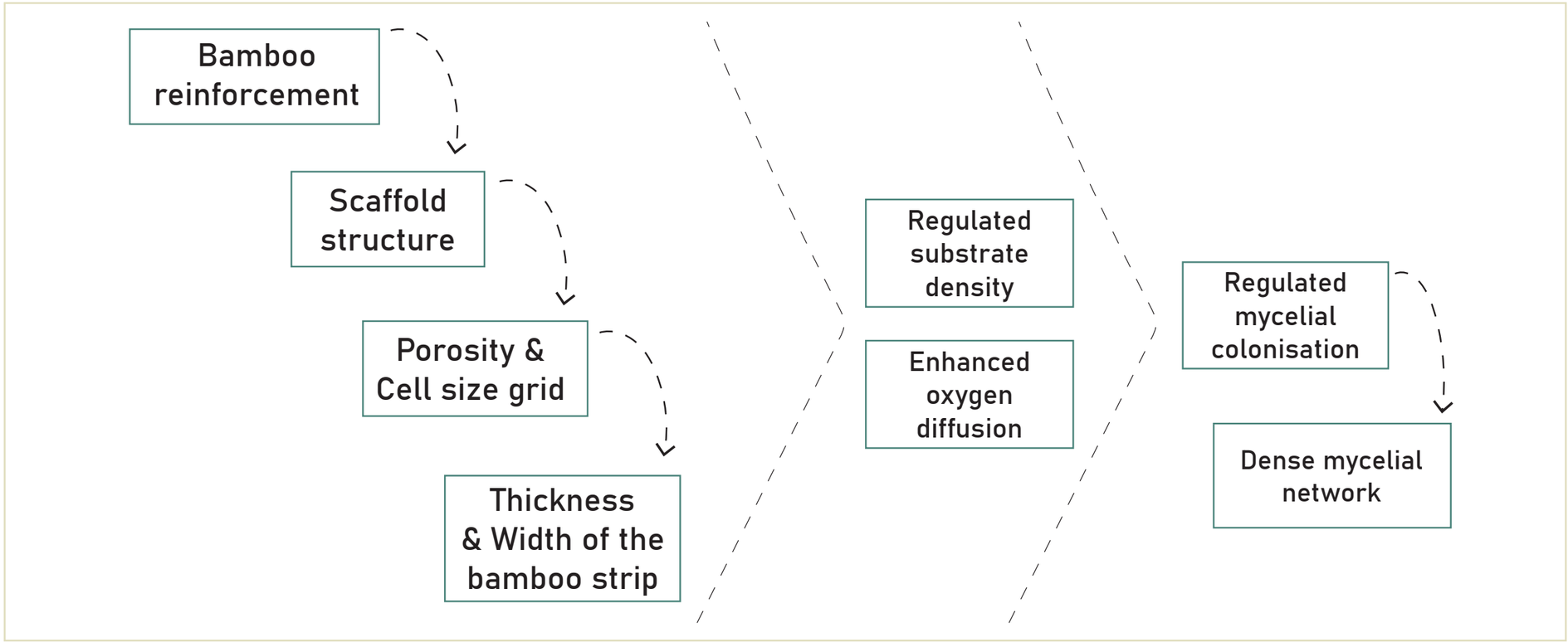
bamboo reinforcement

Variables dependency on dense mycelial network



bamboo reinforcement

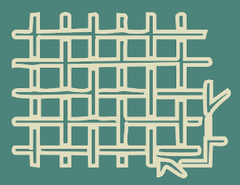
Variables dependency on dense mycelial network



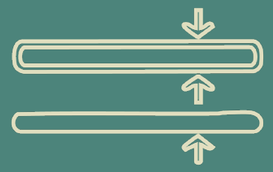
bamboo reinforcement

Primary variables

Evaluating oxygen diffusion



UNIT CELL SIZE : 5mm, 10mm



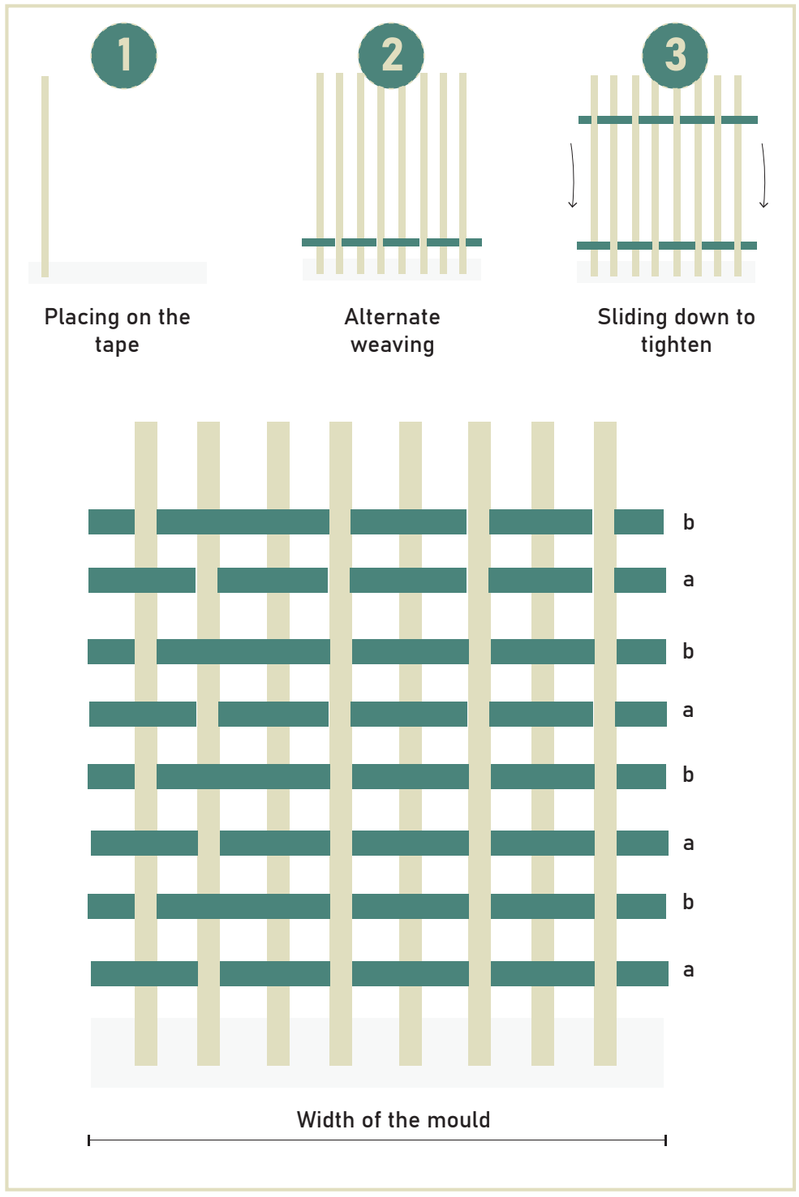
WIDTH OF THE STRIPS : 5mm, 10mm

Dictates the surface area for interfacial bonding

THICKNESS OF THE STRIPS : 1.5mm, 2mm

Calibrating friction at the overlapping contact points

Weaving Bamboo Mats

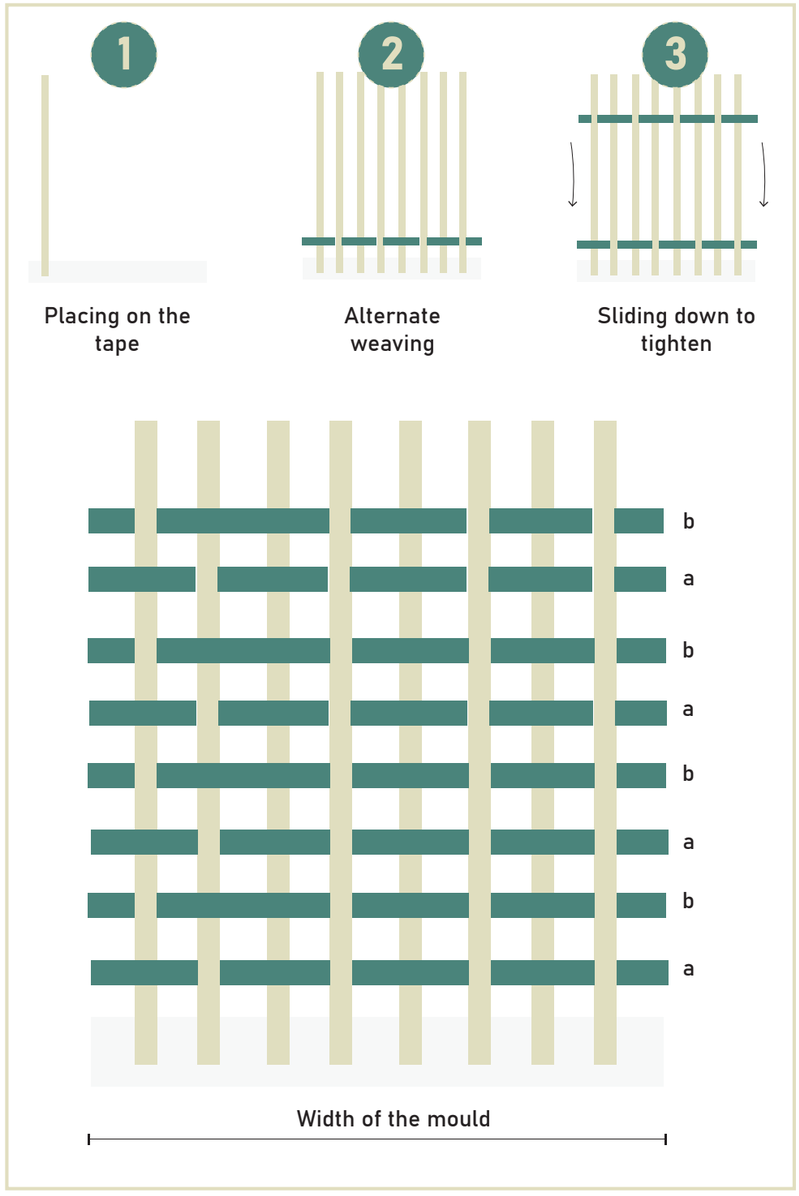


Weaving process

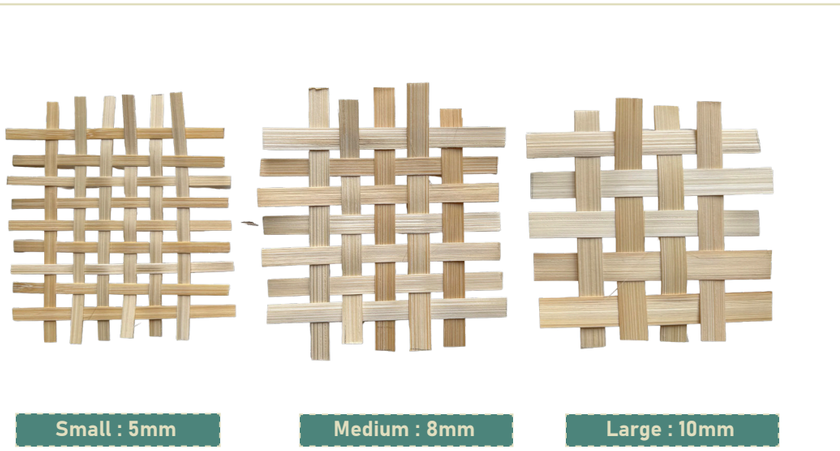
material experimentation

Weaving Bamboo Mats

material experimentation



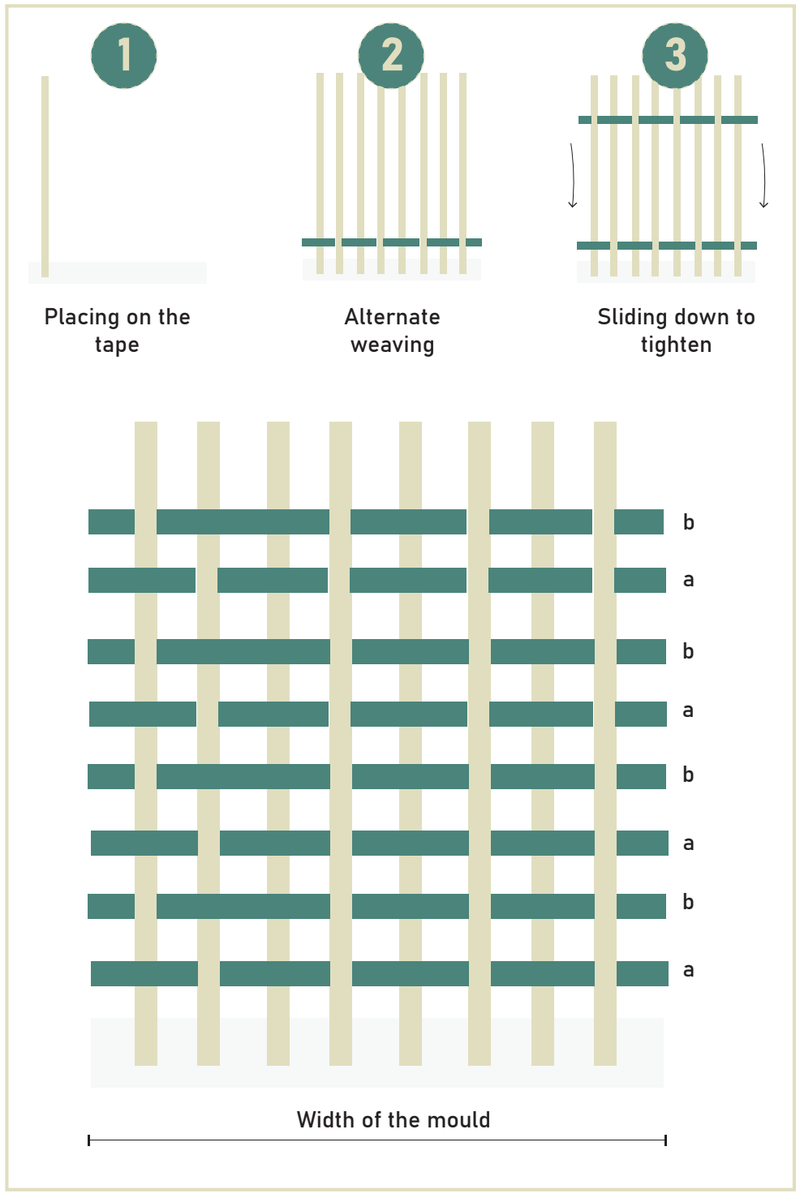
Weaving process



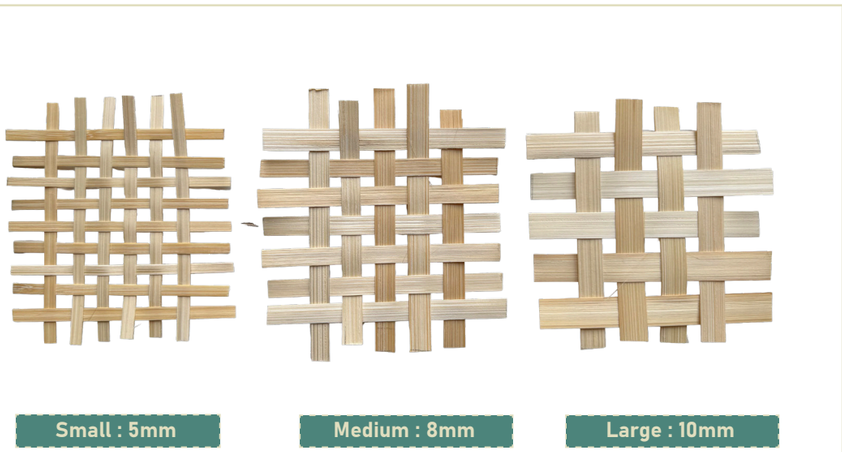
Origin type 01: China
Processed & Machine cut

Weaving Bamboo Mats

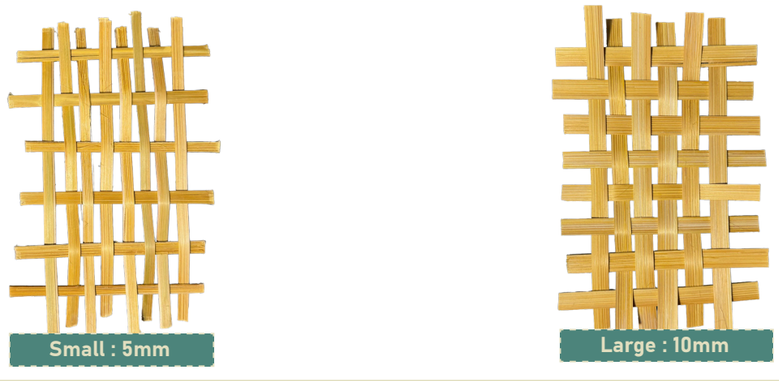
material experimentation



Weaving process



Origin type 01: China
Processed & Machine cut

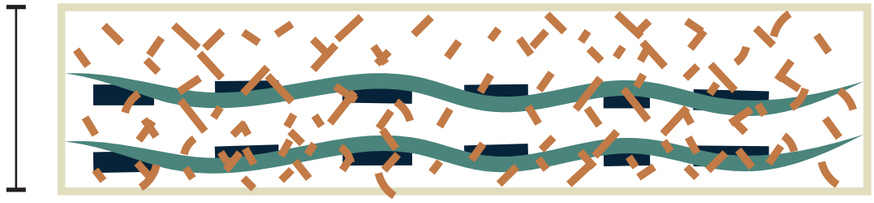


Origin type 02: India
Natural & hand cut

Making of MycoMax material system

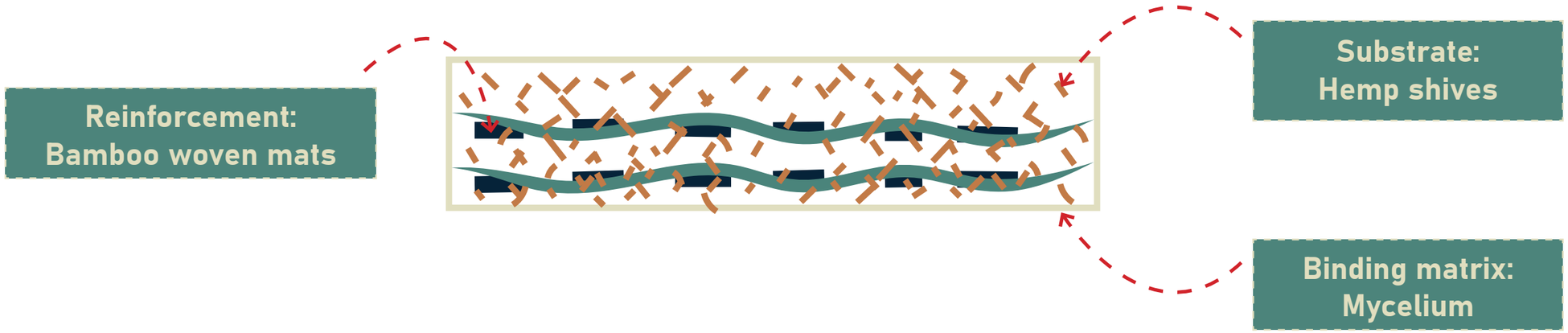
material experimentation

50mm
constant depth

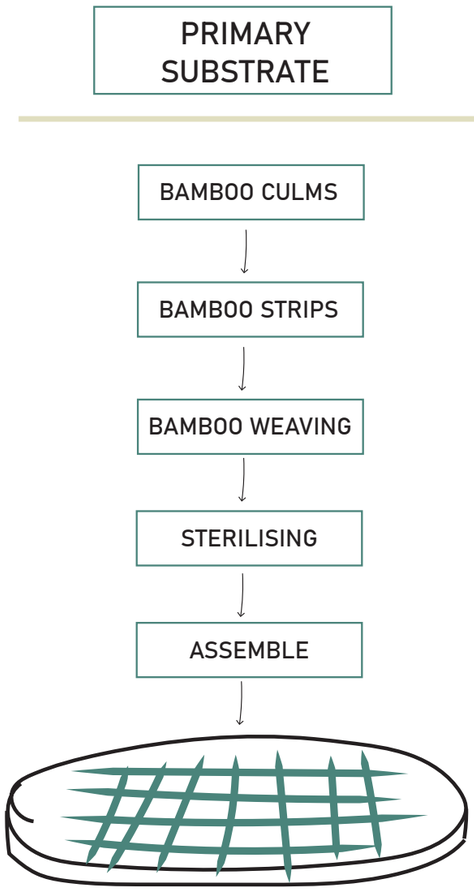


material experimentation

Making of MycoMax material system

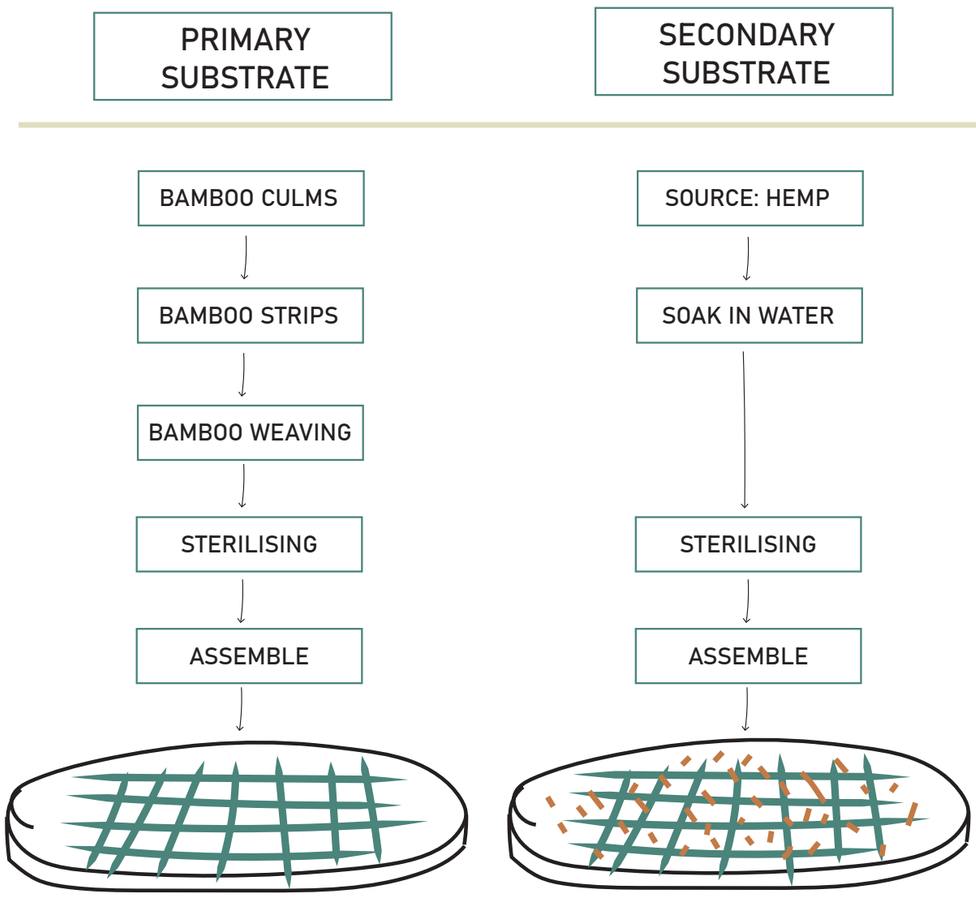


Making of MycoMax material system



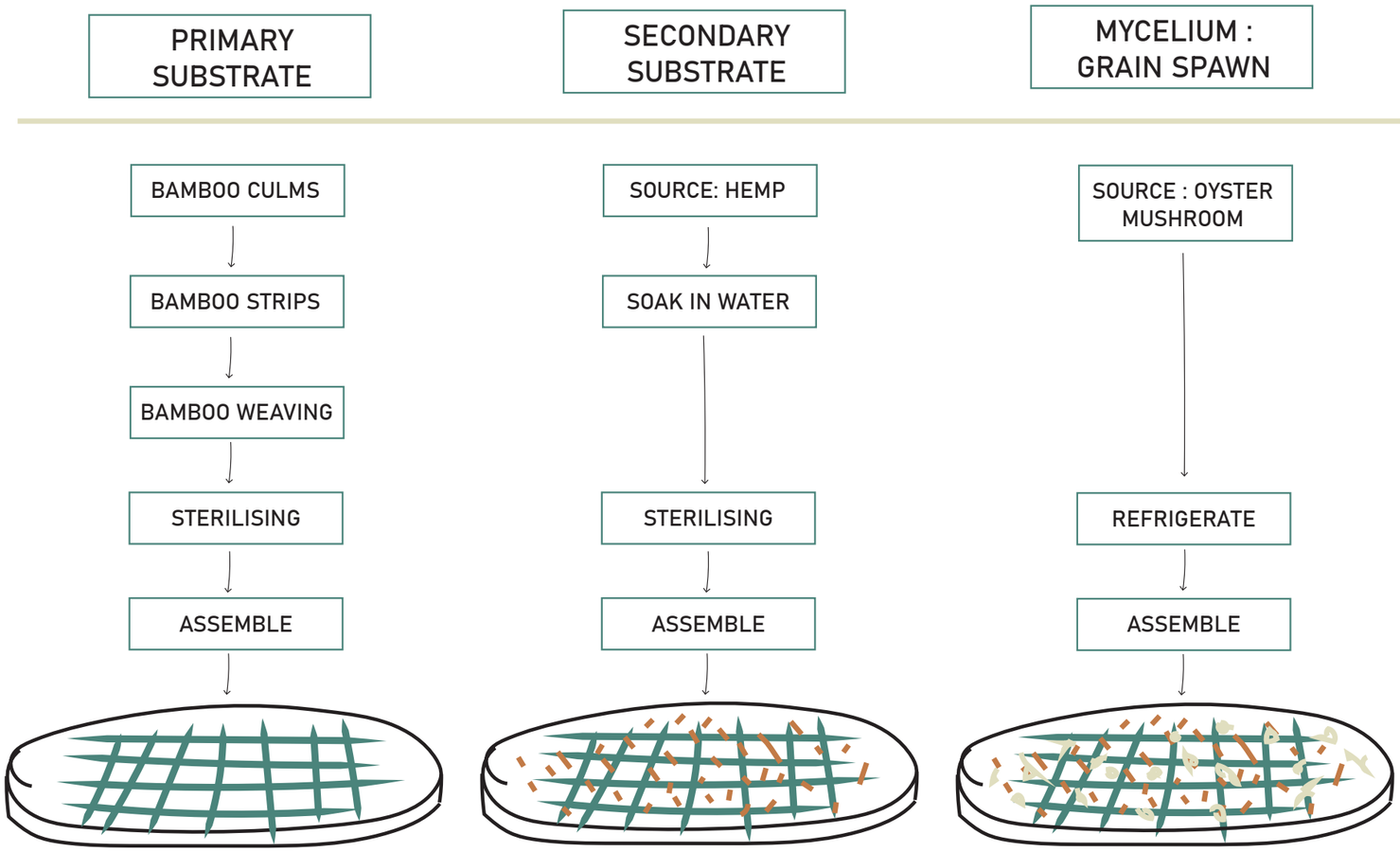
material experimentation

Making of MycoMax material system



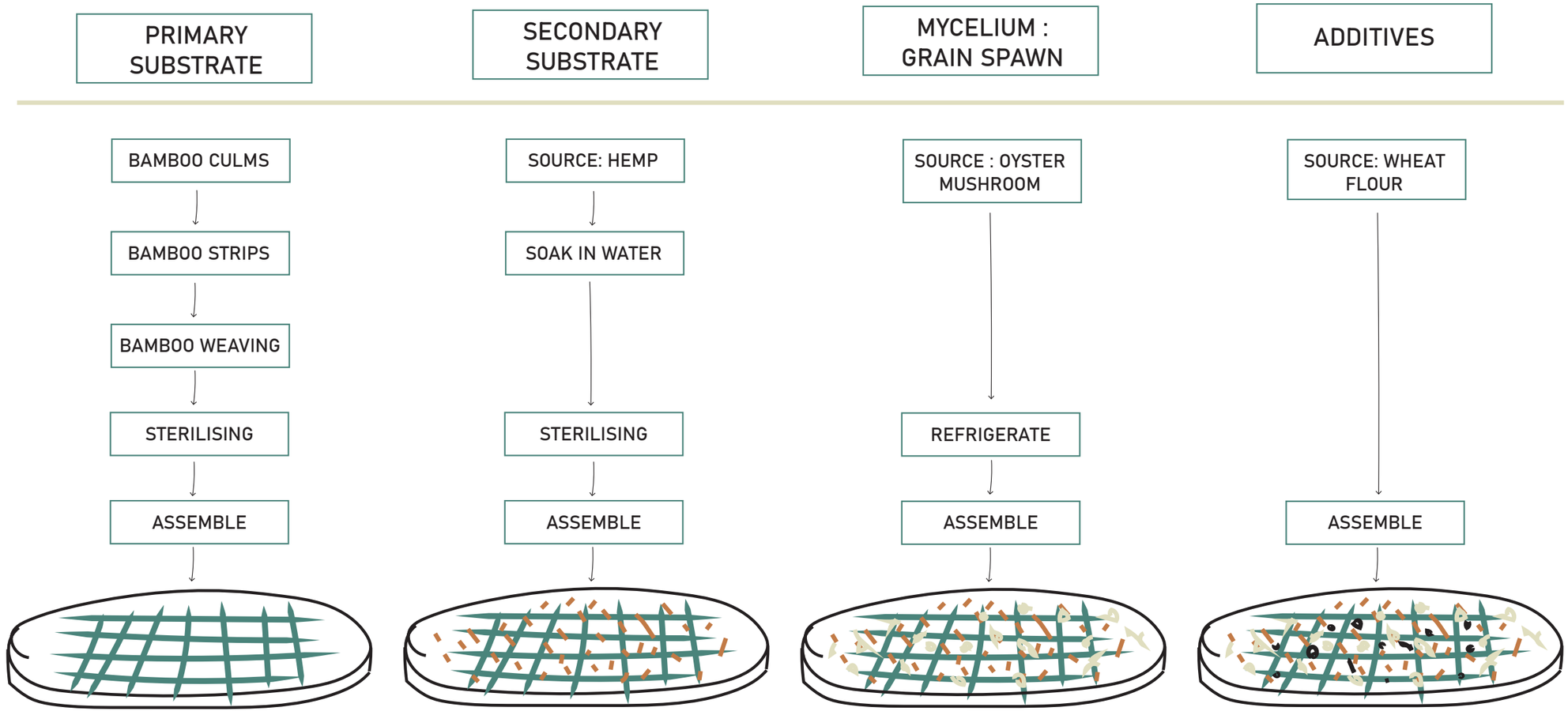
material experimentation

Making of MycoMax material system



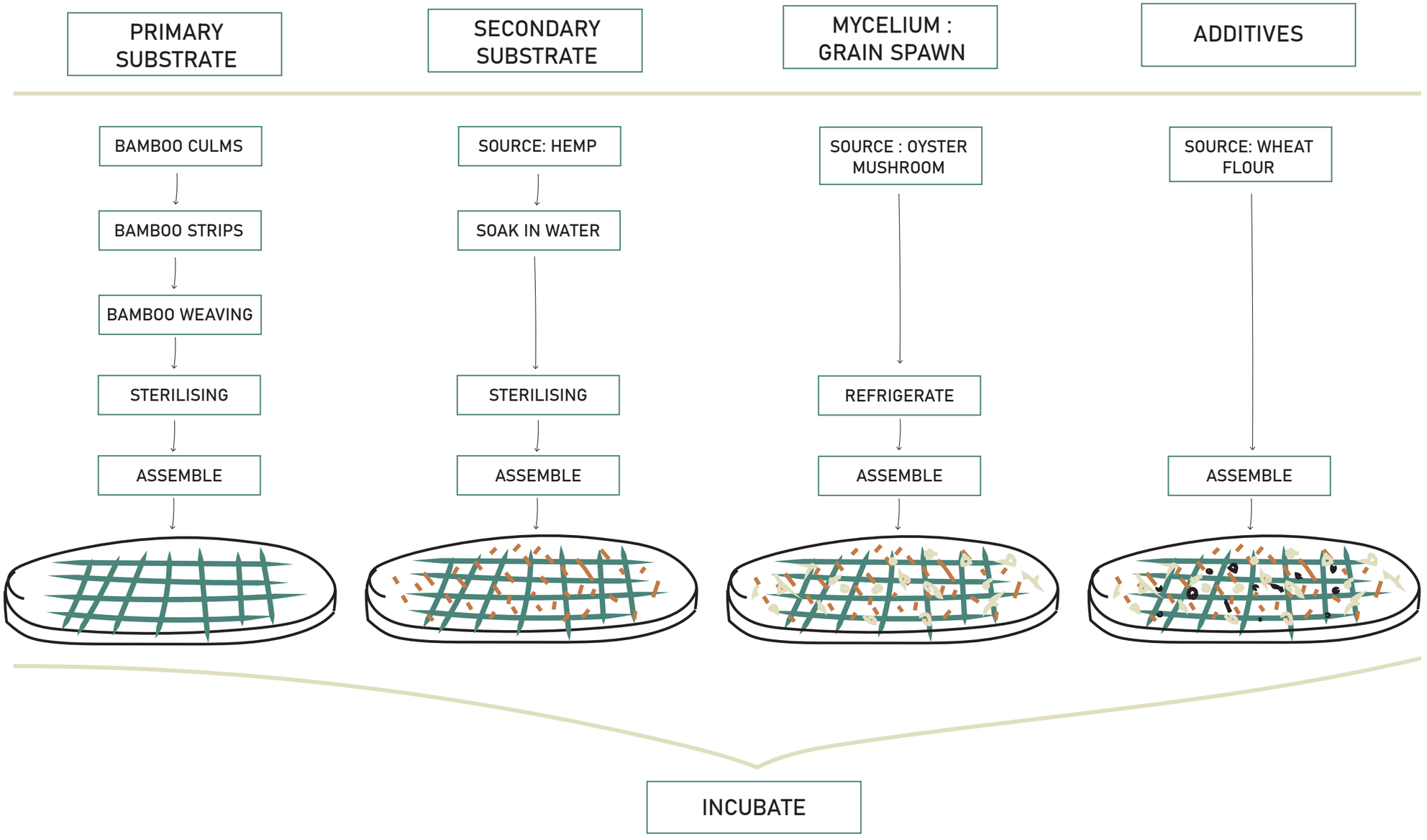
material experimentation

Making of MycoMax material system



material experimentation

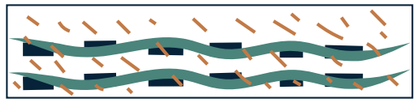
Making of MycoMax material system



material experimentation

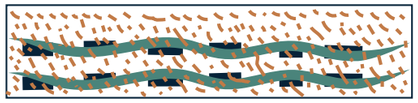
Optimising Fabrication process

Density: 324 kg/m³
hemp : mycelium:
75:25



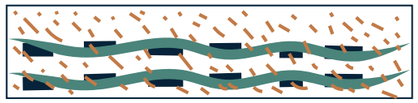
Stage 01

Density: 567 kg/m³
hemp : mycelium:
75:25



Stage 02A

Density: 405 kg/m³
hemp : mycelium : additive:
45:45:10

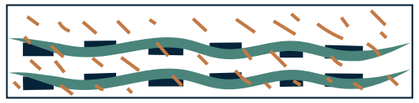


Stage 2B & 03

Stage 2A ---> Stage 2B

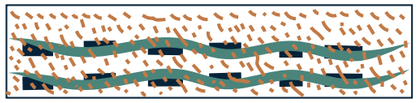
Optimising Fabrication process

Density: 324 kg/m³
hemp : mycelium:
75:25



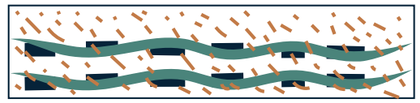
Stage 01

Density: 567 kg/m³
hemp : mycelium:
75:25



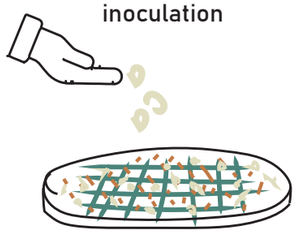
Stage 02A

Density: 405 kg/m³
hemp : mycelium : additive:
45:45:10



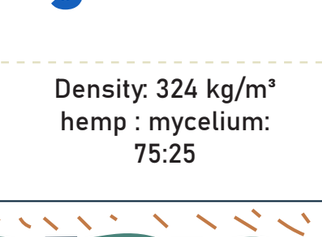
Stage 2B & 03

Mixed during
inoculation



Stage 01

Inoculation Type 01

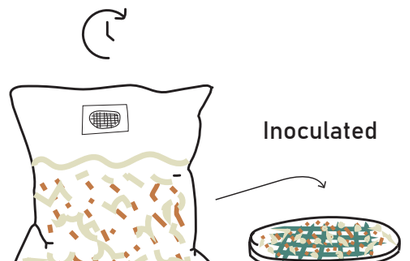


Mixed with the
substrate before
inoculation

Stage 2A

Inoculation Type 02

5 days pre-grown
with the substrate



Inoculated

Stage 2B & 03

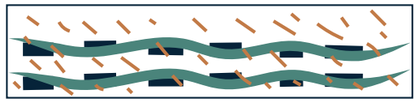
Inoculation Type 03

Stage 2A ---> Stage 2B

Optimising Fabrication process

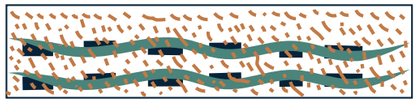
Stage 2A ---> Stage 2B

Density: 324 kg/m³
hemp : mycelium:
75:25



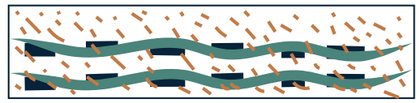
Stage 01

Density: 567 kg/m³
hemp : mycelium:
75:25



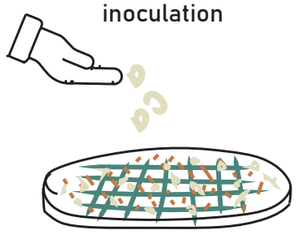
Stage 02A

Density: 405 kg/m³
hemp : mycelium : additive:
45:45:10



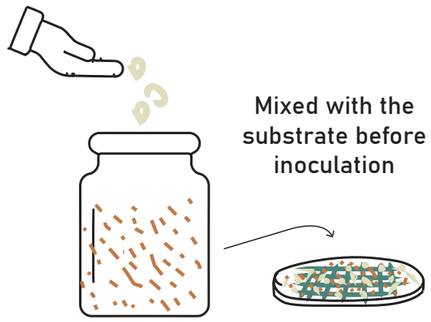
Stage 2B & 03

Mixed during
inoculation



Stage 01

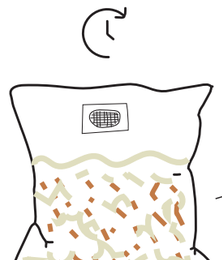
Inoculation Type 01



Stage 2A

Inoculation Type 02

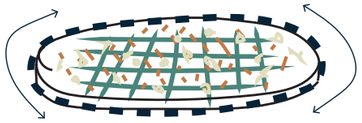
5 days pre-grown
with the substrate



Stage 2B & 03

Inoculation Type 03

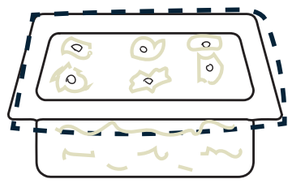
Completely sealed
Minimum growth



Stage 01

Mould + sealing Type 01

Completely sealed
Minimum growth around
the openings

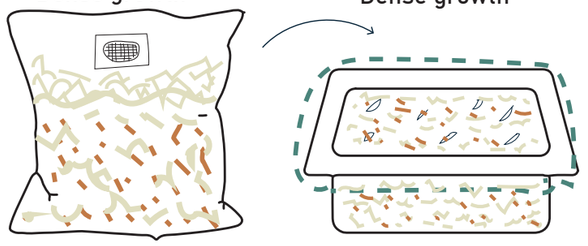


Stage 2A

Mould + sealing Type 02

Inoculation bag + filter
patch
Dense growth

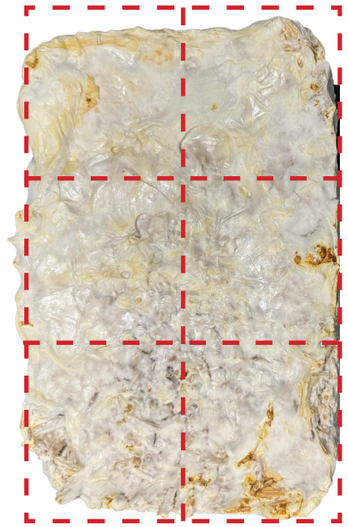
Light cellophane seal +
openings
Dense growth



Stage 2B & 03

Mould + sealing Type 03

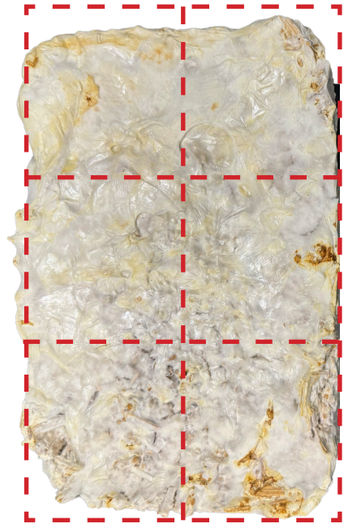
Mechanical characterisation



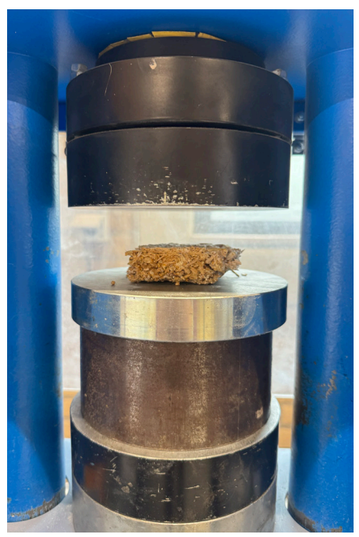
Cutting to specimen size 50mm x 50mm x 50mm

Stage 2B

Mechanical characterisation



Cutting to specimen size 50mm x 50mm

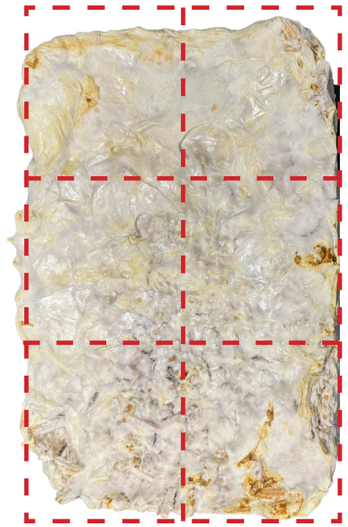


Compression testing

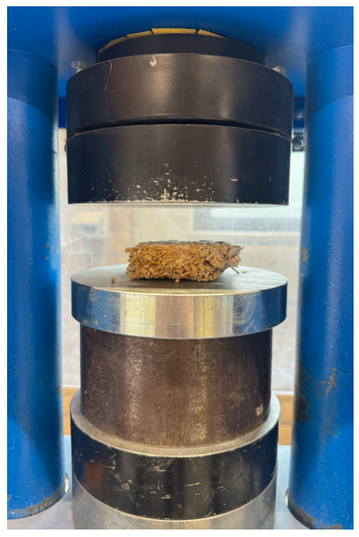
Stage 2B

Mechanical characterisation

Stage 2B



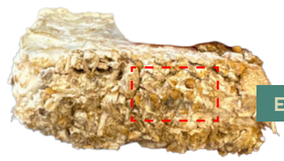
Cutting to specimen size 50mm x 50mm



Compression testing

M.01.H.00

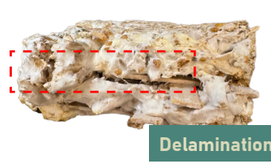
Only Hemp as substrate

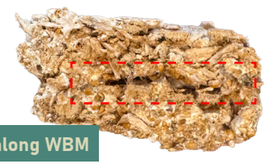


Even mycelial growth

M.02.H.S.I.

Small width. India origin.

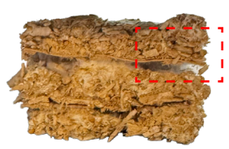




Delamination along WBM

M.03.H.S.C.

Small width. China origin.



air pockets

M.04.H.L.I.

Large width. India origin.

M.05.H.L.C.

Large width. China origin.

Disintegration at the corners

Mycelial growth absent

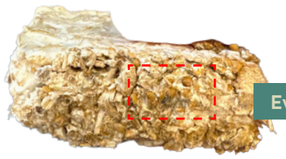
Mechanical characterisation

Stage 2B

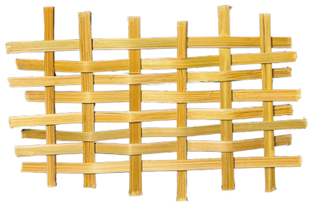
No bamboo

M.01.H.00

Only Hemp as substrate



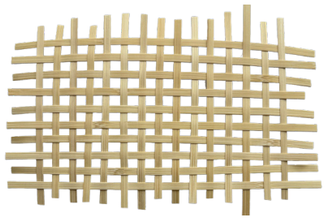
Even mycelial growth



M.02.H.S.I.

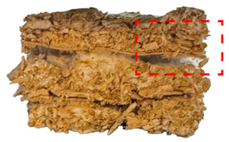
Small width. India origin.

Delamination along WBM

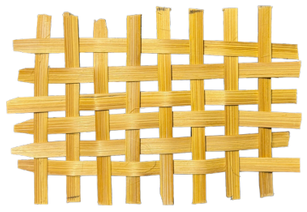


M.03.H.S.C.

Small width. China origin.

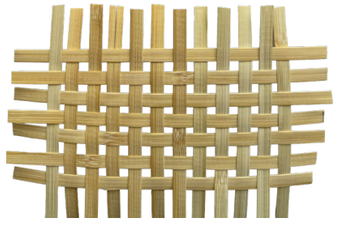


air pockets



M.04.H.L.I.

Large width. India origin.



M.05.H.L.C.

Large width. China origin.

Disintegration at the corners

Mycelial growth absent

Best performing specimen type

10mm width:
Larger surface area to grow

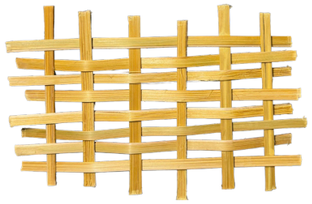
10mm wide openings:

Space for mycelium to growth and connect to the second bamboo mat

No bamboo

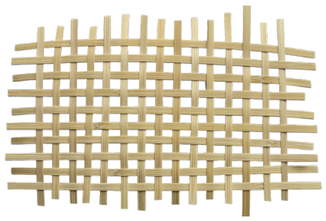
M.01.H.00

Only Hemp as substrate



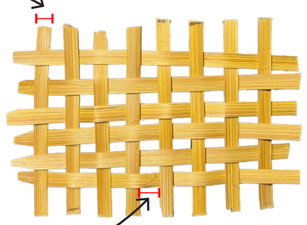
M.02.H.S.I.

Small width. India origin.



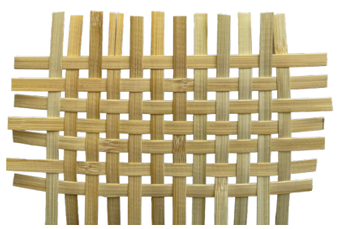
M.03.H.S.C.

Small width. China origin.



M.04.H.L.I.

Large width. India origin.



M.05.H.L.C.

Large width. China origin.

Specimen type	Sr. no.	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength [%] MPa	Mean Density [kg/m^3]	Location of the piece	Observations
M.01.H.00 *(Only hemp; no bamboo)*	1	10.509	1.098	0.458			corner	disintegration at the corners
	2	12.38	1.357	0.565			corner	disintegration at the corners
	3	15.306	2.535	1.056			centre	high mycelial growth
	4	13.747	1.653	0.689	0.692	207	centre	light distintegration
M02. H.S.I. *(Hemp, Small width 5mm, India origin type 02)*	1	8.009	1.055	0.44			corner	complete disintegration and delamination
	2	10.349	1.425	0.594			corner	disintegration at the corners
	3	10.206	1.314	0.548			corner	complete disintegration and delamination
	4	14.379	3.103	1.293			centre	intact
	5	11.785	1.703	0.709	0.717	201	corner	light distintegration
M.03.H.S.C. *(Hemp, Small width 5mm, China origin type 01)*	1	12.772	2.227	0.928			corner	air pockets before testing
	2	11.954	1.653	0.689			corner	delamination; disintegration at the corners
	3	6.914	0.759	0.316			centre	high mycelial growth
	4	10.91	1.703	0.709	0.661	179	centre	complete disintegration and delamination
M04. H. L. I. *(Hemp, Large width 10mm, India origin type 02)*	1	14.828	3.128	1.303			corner	light distintegration
	2	15.074	3.233	1.347			corner	delamination
	3	12.434	2.344	0.977			corner	delamination
	4	11.399	1.875	0.781			corner	complete disintegration and delamination
	5	12.005	2.381	0.992			centre	light distintegration
	6	14.202	3.701	1.542	1.157	208	centre	light distintegration
M05.H.L.C. *(Hemp, Large width 10mm, China origin type 01)*	1	13.235	3.467	1.445			centre	disintegration at the corners
	2	12.594	2.714	1.131			centre	disintegration at the corners
	3	12.211	2.104	0.877			corner	uneven deformation due to large air pockets
	4	8.138	1.049	0.437			corner	mycelial growth minimum
	5	8.003	1.178	0.491			corner	delamination; disintegration at the corners
	6	15.049	2.967	1.236	0.936	223	corner	high mycelial growth; highest deformation due to more air pockets

Highest yield strength of 1.157 MPa

Stage 2B

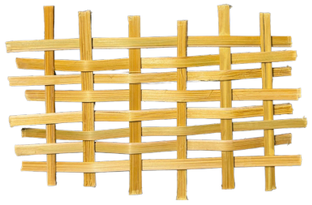
Unreinforced VS Reinforced

70% stronger
with reinforcement

No bamboo

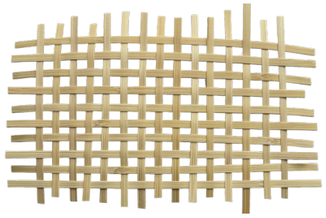
M.01.H.00

Only Hemp
as substrate



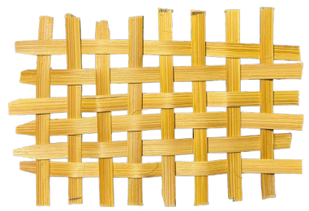
M.02.H.S.I.

Small width.
India origin.



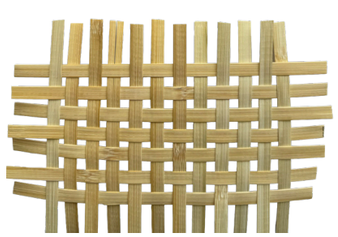
M.03.H.S.C.

Small width.
China origin.



M.04.H.L.I.

Large width.
India origin.



M.05.H.L.C.

Large width.
China origin.

Specimen type	Sr. no.	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength [%] MPa	Mean Density [kg/m^3]	Location of the piece	Observations
M.01.H.00 *(Only hemp; no bamboo)*	1	10.509	1.098	0.458	0.692 MPa		corner	disintegration at the corners
	2	12.38	1.357	0.565			corner	disintegration at the corners
	3	15.306	2.535	1.056			centre	high mycelial growth
	4	13.747	1.653	0.689	0.692	207	centre	light distintegration
M02. H.S.I. *(Hemp, Small width 5mm, India origin type 02)*	1	8.009	1.055	0.44			corner	complete disintegration and delamination
	2	10.349	1.425	0.594			corner	disintegration at the corners
	3	10.206	1.314	0.548			corner	complete disintegration and delamination
	4	14.379	3.103	1.293			centre	intact
	5	11.785	1.703	0.709	0.717	201	corner	light distintegration
M.03.H.S.C. *(Hemp, Small width 5mm, China origin type 01)*	1	12.772	2.227	0.928			corner	air pockets before testing
	2	11.954	1.653	0.689			corner	delamination; disintegration at the corners
	3	6.914	0.759	0.316			centre	high mycelial growth
	4	10.91	1.703	0.709	0.661	179	centre	complete disintegration and delamination
M04. H. L. I. *(Hemp, Large width 10mm, India origin type 02)*	1	14.828	3.128	1.303			corner	light distintegration
	2	15.074	3.233	1.347			corner	delamination
	3	12.434	2.344	0.977	1.157 MPa		corner	delamination
	4	11.399	1.875	0.781			corner	complete disintegration and delamination
	5	12.005	2.381	0.992			centre	light distintegration
	6	14.202	3.701	1.542	1.157	208	centre	light distintegration
M05.H.L.C. *(Hemp, Large width 10mm, China origin type 01)*	1	13.235	3.467	1.445			centre	disintegration at the corners
	2	12.594	2.714	1.131			centre	disintegration at the corners
	3	12.211	2.104	0.877			corner	uneven deformation due to large air pockets
	4	8.138	1.049	0.437			corner	mycelial growth minimum
	5	8.003	1.178	0.491			corner	delamination; disintegration at the corners
	6	15.049	2.967	1.236	0.936	223	corner	high mycelial growth; highest deformation due to more air pockets

10mm Large VS 5mm Small Width

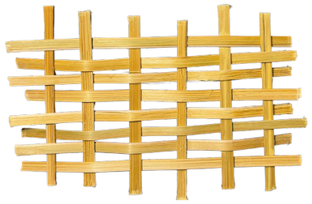
Stage 2B

No bamboo

Large width
60% stronger

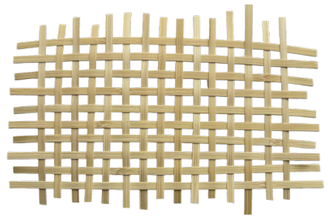
M.01.H.00

Only Hemp
as substrate



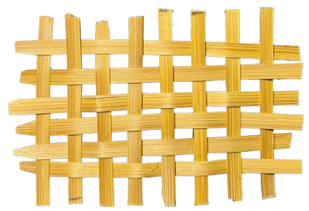
M.02.H.S.I.

Small width.
India origin.



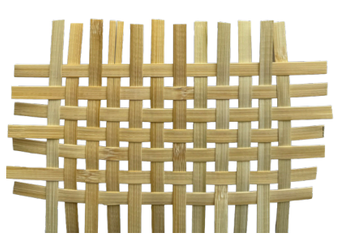
M.03.H.S.C.

Small width.
China origin.



M.04.H.L.I.

Large width.
India origin.



M.05.H.L.C.

Large width.
China origin.

Specimen type	Sr. no.	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength [%] MPa	Mean Density [kg/m^3]	Location of the piece	Observations
M.01.H.00 *(Only hemp; no bamboo)*	1	10.509	1.098	0.458			corner	disintegration at the corners
	2	12.38	1.357	0.565			corner	disintegration at the corners
	3	15.306	2.535	1.056			centre	high mycelial growth
	4	13.747	1.653	0.689	0.692	207	centre	light distintegration
M02. H.S.I. *(Hemp, Small width 5mm, India origin type 02)*	1	8.009	1.055	0.44			corner	complete disintegration and delamination
	2	10.349	1.425	0.594	0.717 MPa		corner	disintegration at the corners
	3	10.206	1.314	0.548			corner	complete disintegration and delamination
	4	14.379	3.103	1.293			centre	intact
	5	11.785	1.703	0.709	0.717	201	corner	light distintegration
M.03.H.S.C. *(Hemp, Small width 5mm, China origin type 01)*	1	12.772	2.227	0.928			corner	air pockets before testing
	2	11.954	1.653	0.689			corner	delamination; disintegration at the corners
	3	6.914	0.759	0.316			centre	high mycelial growth
	4	10.91	1.703	0.709	0.661	179	centre	complete disintegration and delamination
M04. H. L. I. *(Hemp, Large width 10mm, India origin type 02)*	1	14.828	3.128	1.303			corner	light distintegration
	2	15.074	3.233	1.347			corner	delamination
	3	12.434	2.344	0.977			corner	delamination
	4	11.399	1.875	0.781	1.157 MPa		corner	complete disintegration and delamination
	5	12.005	2.381	0.992			centre	light distintegration
	6	14.202	3.701	1.542	1.157	208	centre	light distintegration
M05.H.L.C. *(Hemp, Large width 10mm, China origin type 01)*	1	13.235	3.467	1.445			centre	disintegration at the corners
	2	12.594	2.714	1.131			centre	disintegration at the corners
	3	12.211	2.104	0.877			corner	uneven deformation due to large air pockets
	4	8.138	1.049	0.437			corner	mycelial growth minimum
	5	8.003	1.178	0.491			corner	delamination; disintegration at the corners
	6	15.049	2.967	1.236	0.936	223	corner	high mycelial growth; highest deformation due to more air pockets

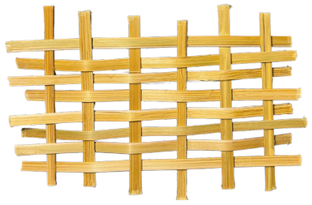
India origin VS China origin

Stage 2B

No bamboo

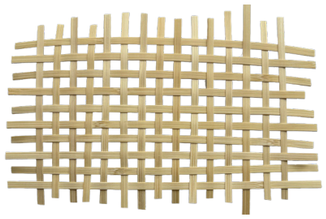
M.01.H.00

Only Hemp as substrate



M.02.H.S.I.

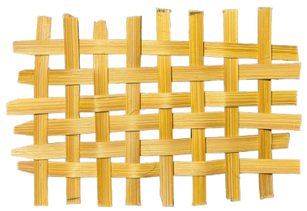
Small width. India origin.



M.03.H.S.C.

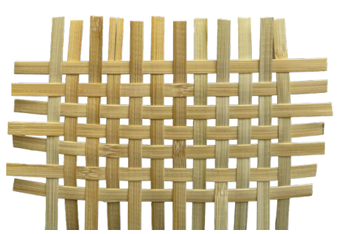
Small width. China origin.

Indian origin
20% stronger



M.04.H.L.I.

Large width. India origin.

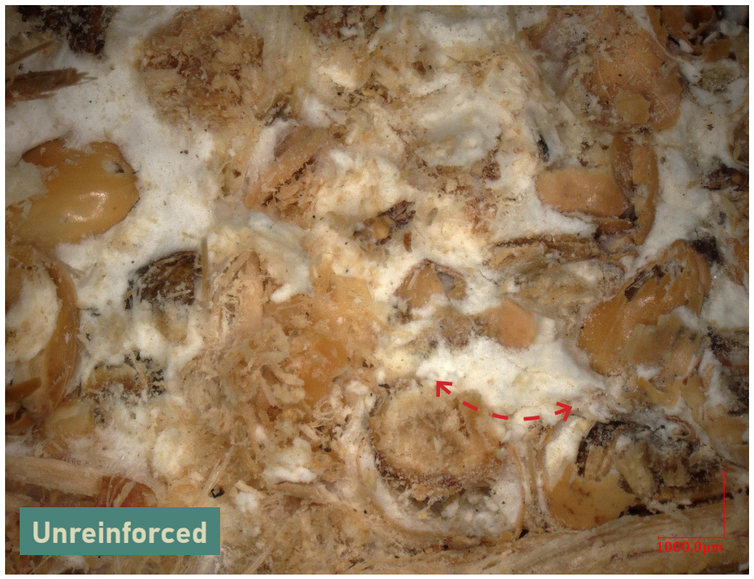


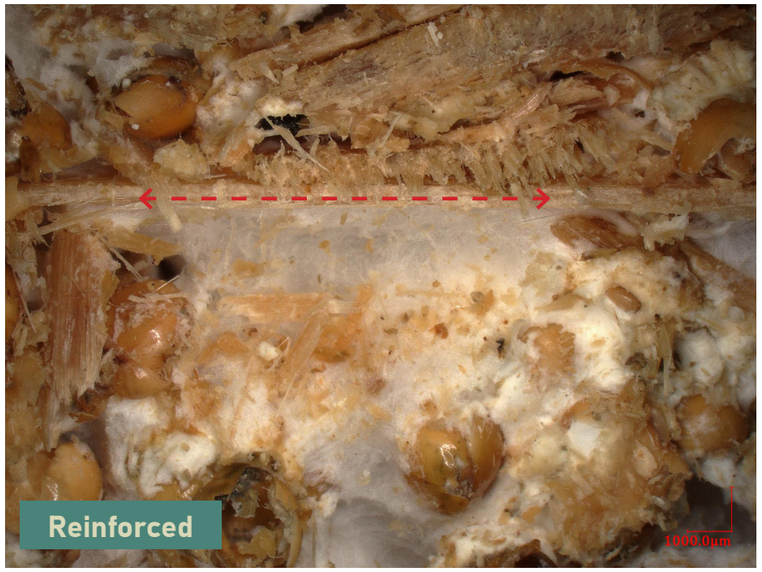
M.05.H.L.C.

Large width. China origin.

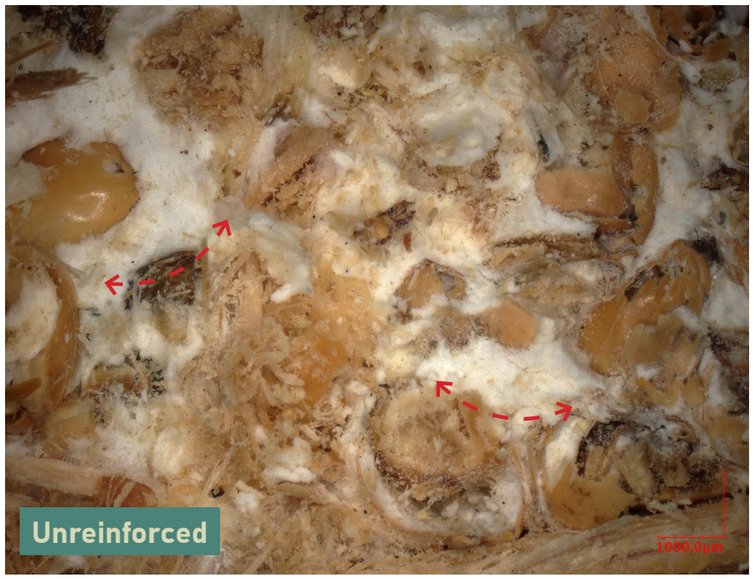
Specimen type	Sr. no.	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength [%] MPa	Mean Density [kg/m^3]	Location of the piece	Observations
M.01.H.00 *(Only hemp; no bamboo)*	1	10.509	1.098	0.458			corner	disintegration at the corners
	2	12.38	1.357	0.565			corner	disintegration at the corners
	3	15.306	2.535	1.056			centre	high mycelial growth
	4	13.747	1.653	0.689	0.692	207	centre	light distintegration
M02. H.S.I. *(Hemp, Small width 5mm, India origin type 02)*	1	8.009	1.055	0.44			corner	complete disintegration and delamination
	2	10.349	1.425	0.594			corner	disintegration at the corners
	3	10.206	1.314	0.548			corner	complete disintegration and delamination
	4	14.379	3.103	1.293			centre	intact
	5	11.785	1.703	0.709	0.717	201	corner	light distintegration
M.03.H.S.C. *(Hemp, Small width 5mm, China origin type 01)*	1	12.772	2.227	0.928			corner	air pockets before testing
	2	11.954	1.653	0.689			corner	delamination; disintegration at the corners
	3	6.914	0.759	0.316			centre	high mycelial growth
	4	10.91	1.703	0.709	0.661	179	centre	complete disintegration and delamination
M04. H. L. I. *(Hemp, Large width 10mm, India origin type 02)*	1	14.828	3.128	1.303	1.157 MPa		corner	light distintegration
	2	15.074	3.233	1.347			corner	delamination
	3	12.434	2.344	0.977			corner	delamination
	4	11.399	1.875	0.781			corner	complete disintegration and delamination
	5	12.005	2.381	0.992			centre	light distintegration
	6	14.202	3.701	1.542	1.157	208	centre	light distintegration
M05.H.L.C. *(Hemp, Large width 10mm, China origin type 01)*	1	13.235	3.467	1.445	0.936 MPa		centre	disintegration at the corners
	2	12.594	2.714	1.131			centre	disintegration at the corners
	3	12.211	2.104	0.877			corner	uneven deformation due to large air pockets
	4	8.138	1.049	0.437			corner	mycelial growth minimum
	5	8.003	1.178	0.491			corner	delamination; disintegration at the corners
	6	15.049	2.967	1.236	0.936	223	corner	high mycelial growth; highest deformation due to more air pockets

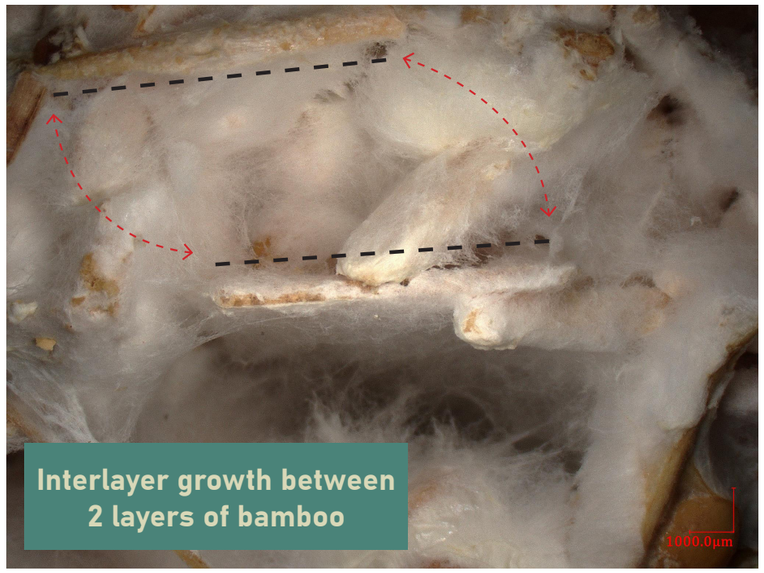
Microscopy Analysis

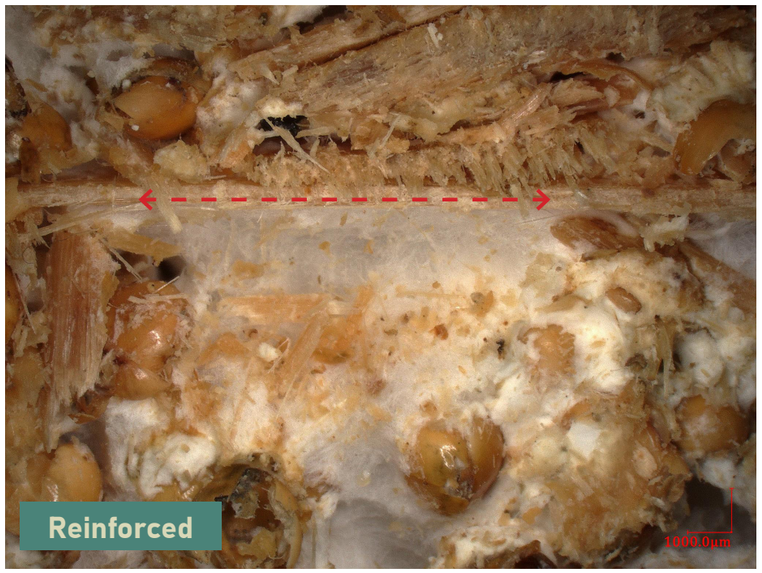


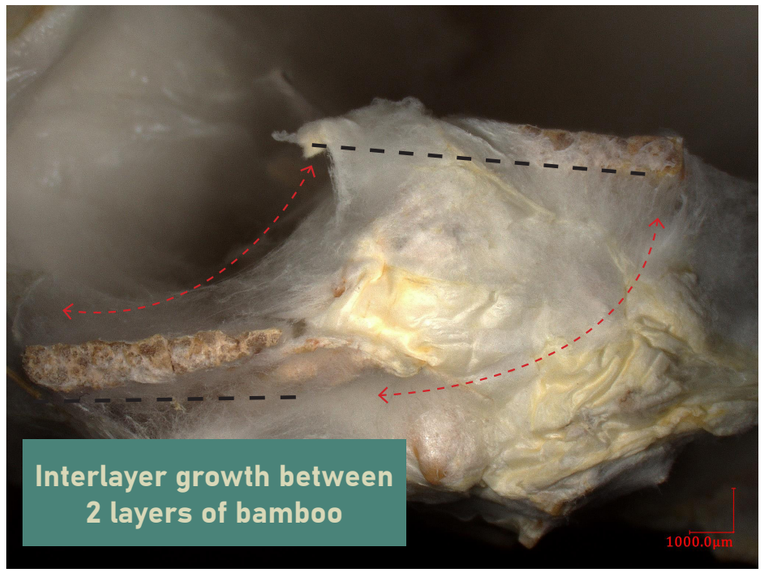


Microscopy Analysis

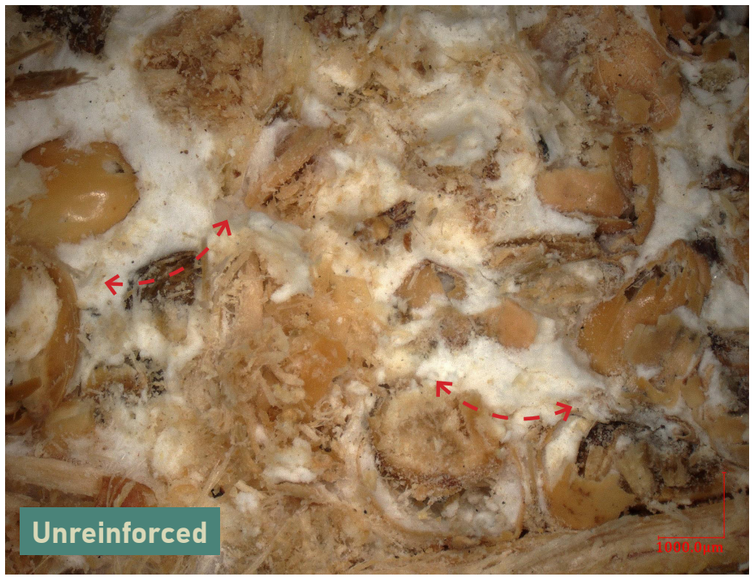


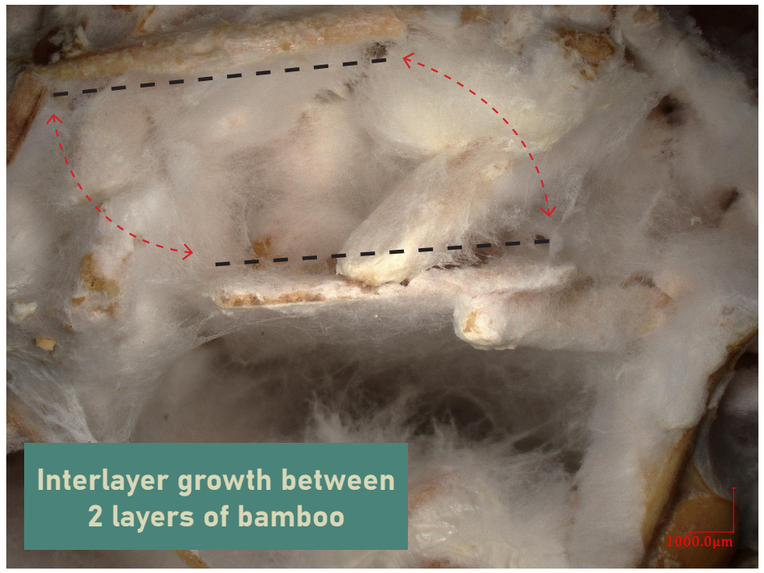


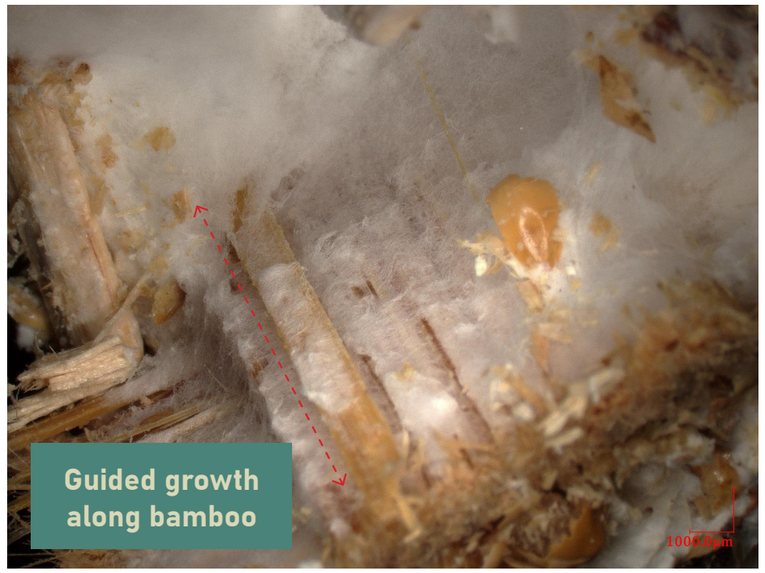


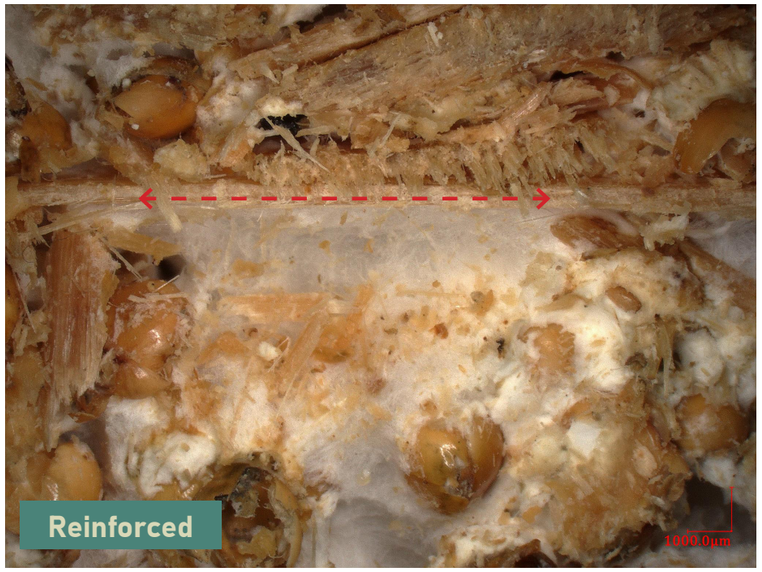


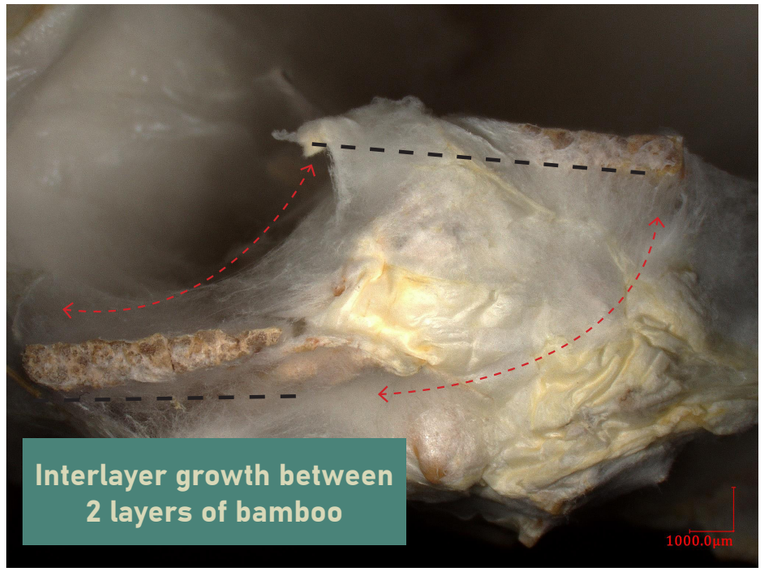
Microscopy Analysis







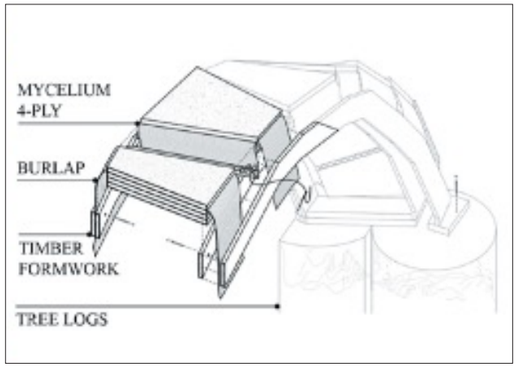




Modular design

Mycotree - Seoul Biennale, 2017

Serpentine wall study - assembling bio welded components, 1200mm tall



Mycoshell - Bethel woods, NY

Assembly of CNC cut 8mm thick components

Reference : Heisel, 2017

Post-tensioning the prototype - tightening the cables

Reference : Dessi-Olive, 2022

Bio-welding creating thicker panels (24 mm, 48 mm, and 72 mm) with improved stiffness and load distribution

Reference : Wisniewska et al., 2025

Form explorations

Pre-fabricated MBCs for Project Phoenix by Ecovative; Extrusion form sketch design

Form explorations

Pre-fabricated MBCs for Project Phoenix by Ecovative; Extrusion form sketch design

Extrusion section design

Bombay bhel side table by Tiny Cane Collective; Prelimnary sketch design

Panel design

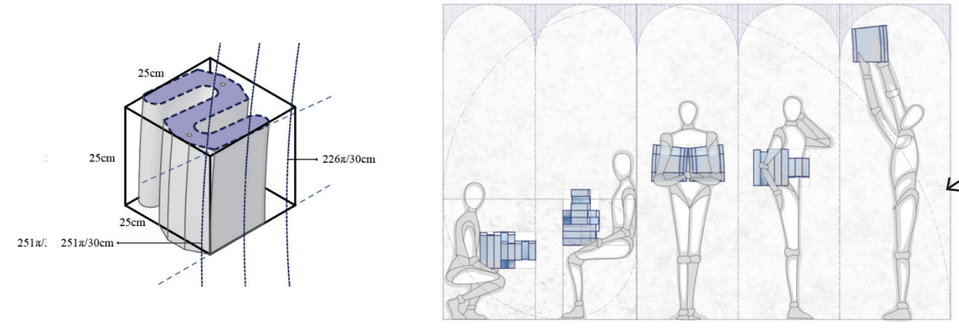
Form explorations

Pre-fabricated MBCs for Project Phoenix by Ecovative; Extrusion form sketch design

Extrusion section design

Bombay bhel side table by Tiny Cane Collective; Prelimnary sketch design

Panel design



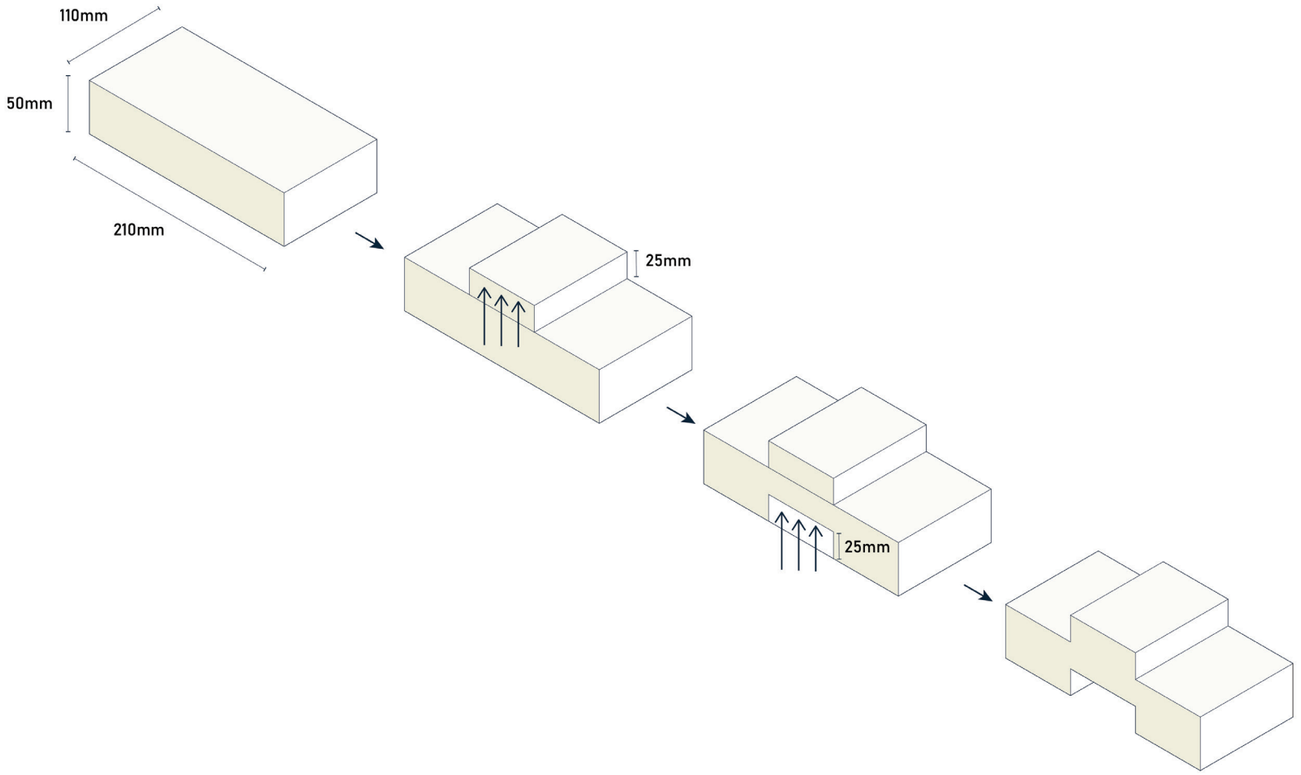
Module ergonomic analysis (Source: Tseng et al., 2024)

Ergonomic block Design

Interlocking block design

50mm thickness

Interlocking blocks

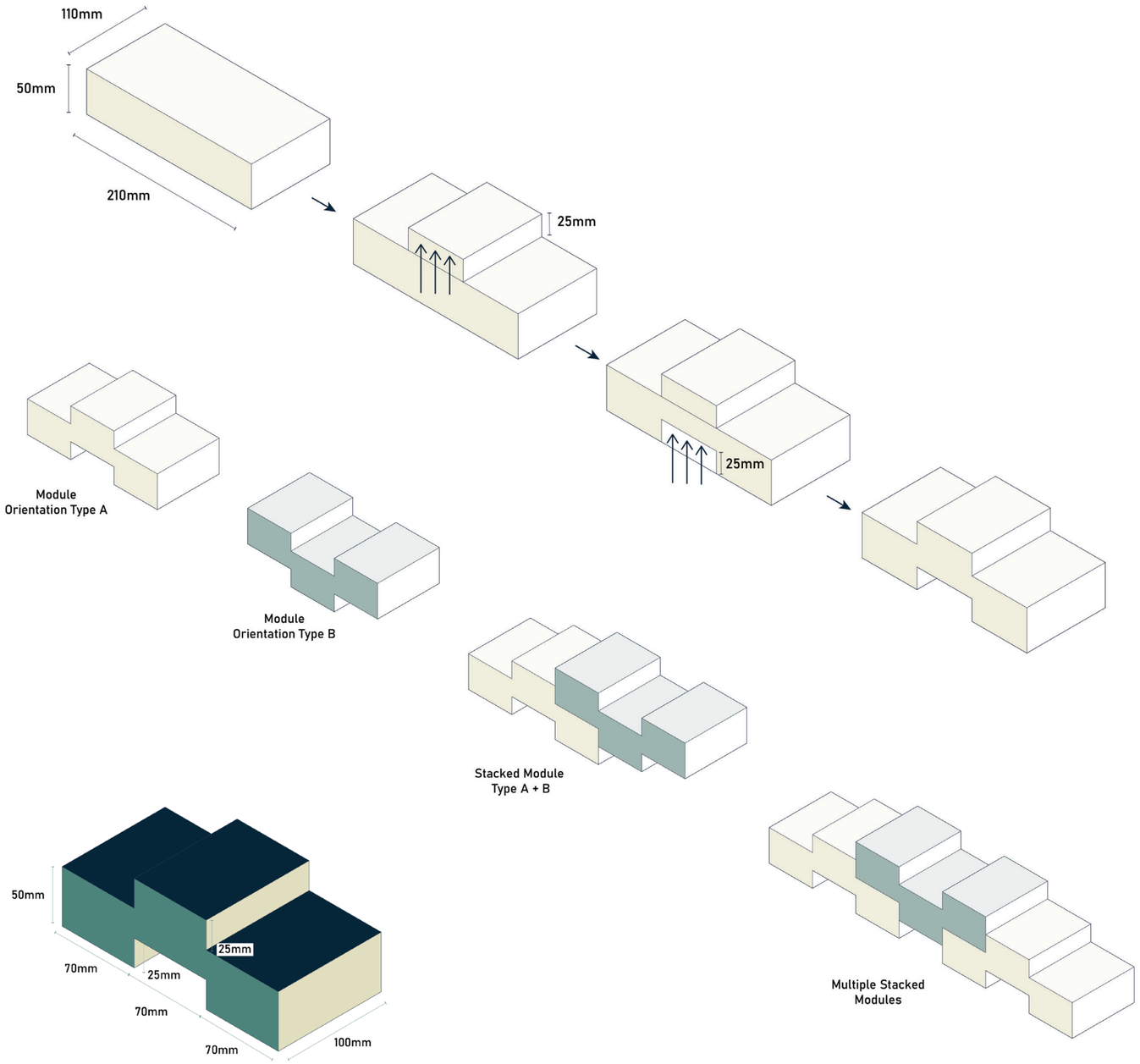


product design

Interlocking block design

50mm thickness

Interlocking blocks

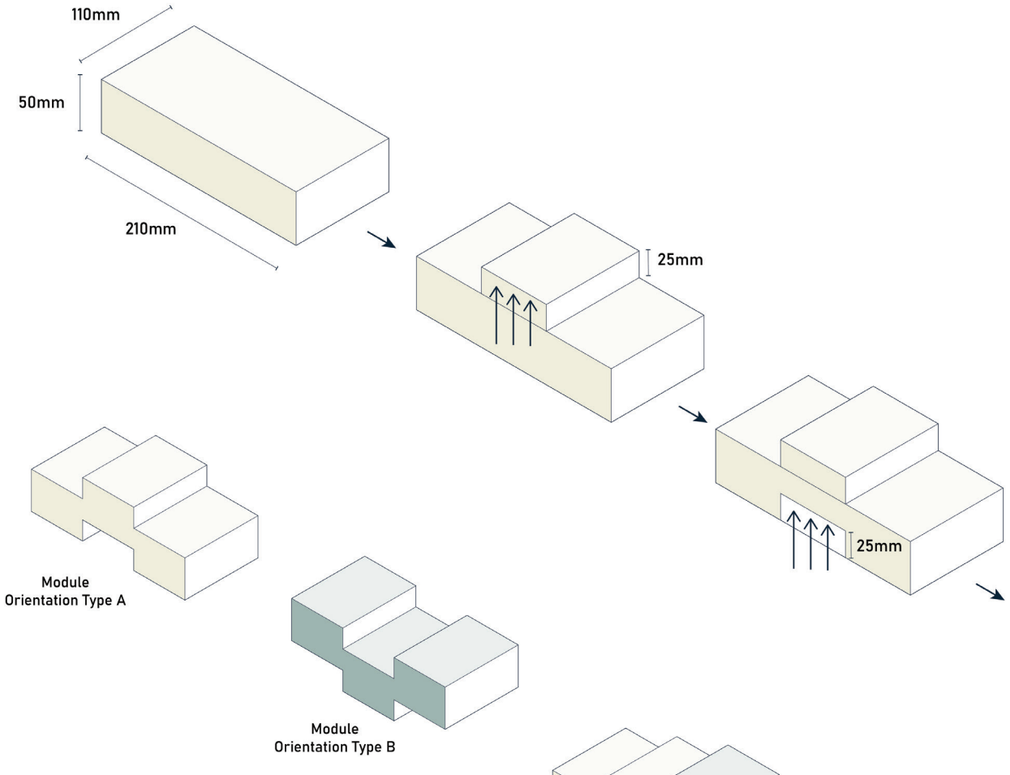


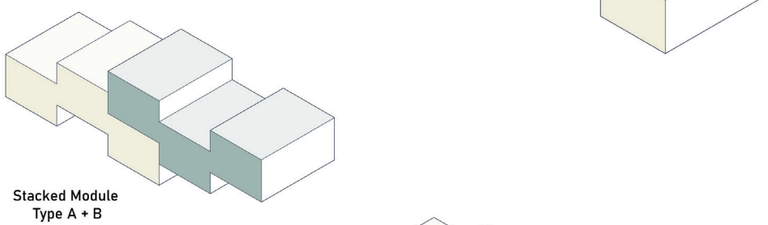
product design

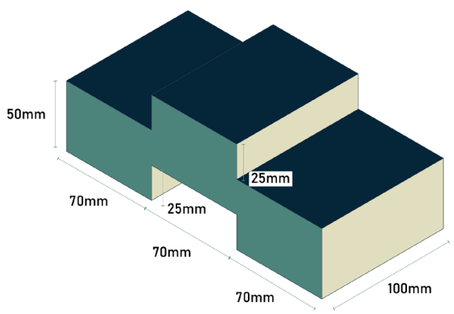
Interlocking block design

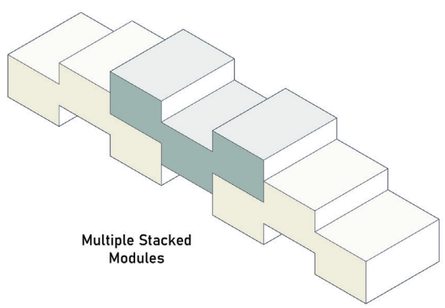
50mm thickness

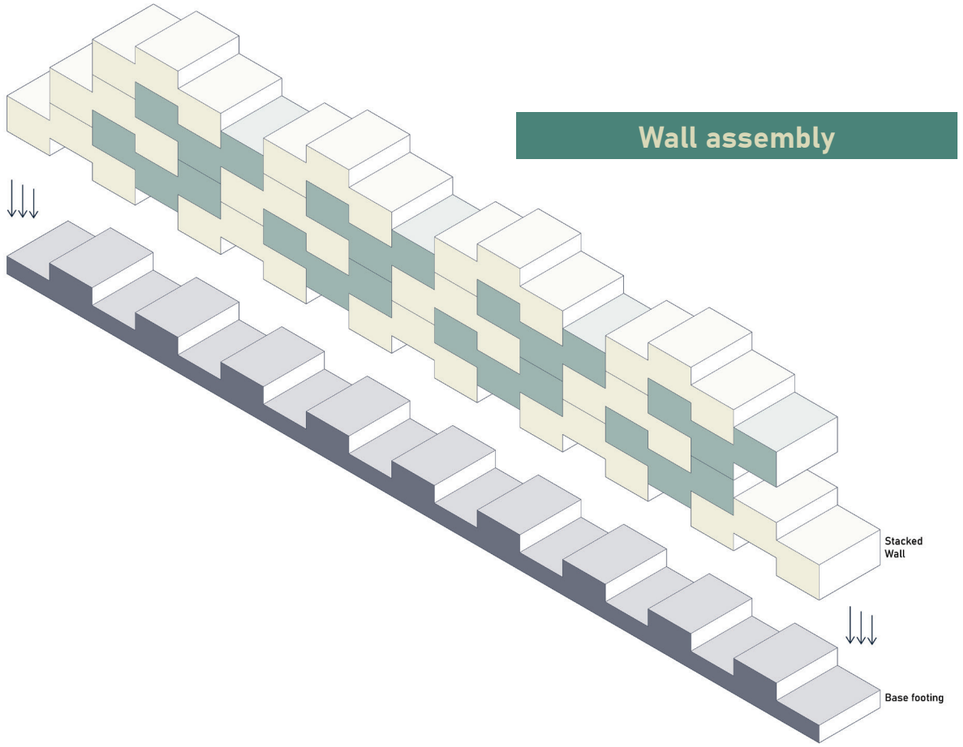
Interlocking blocks





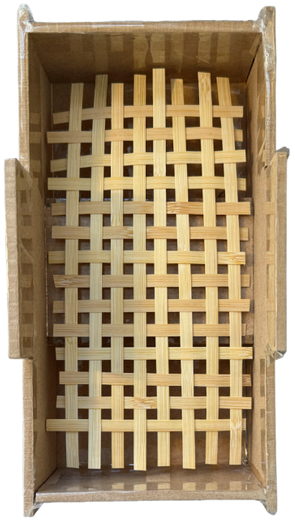




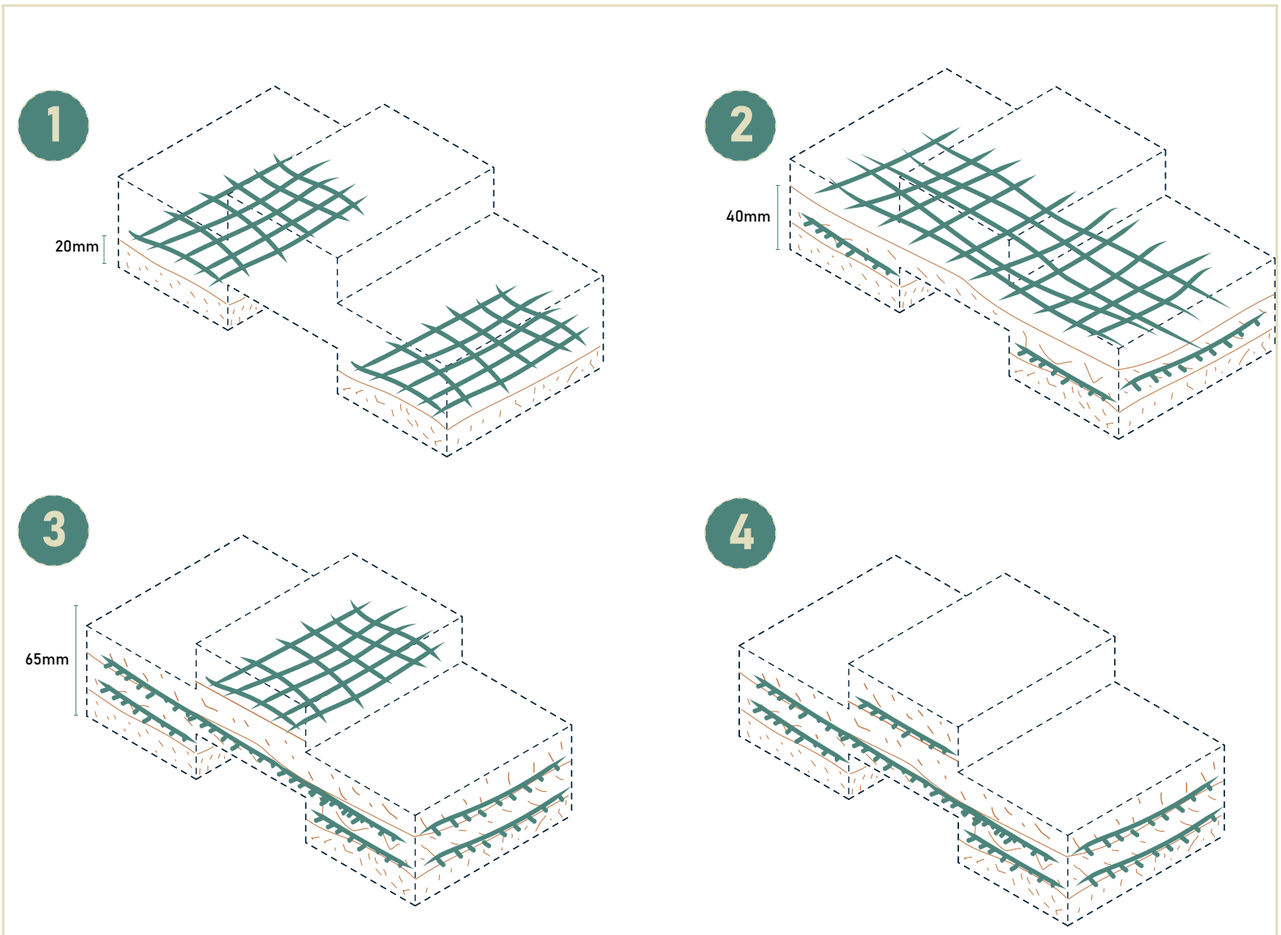


product design

Assembly



Module mould and weaving



Assembly sequence

Compression tests: Stage 03

Filler blocks for parallel surfaces; Before and after

Compression tests

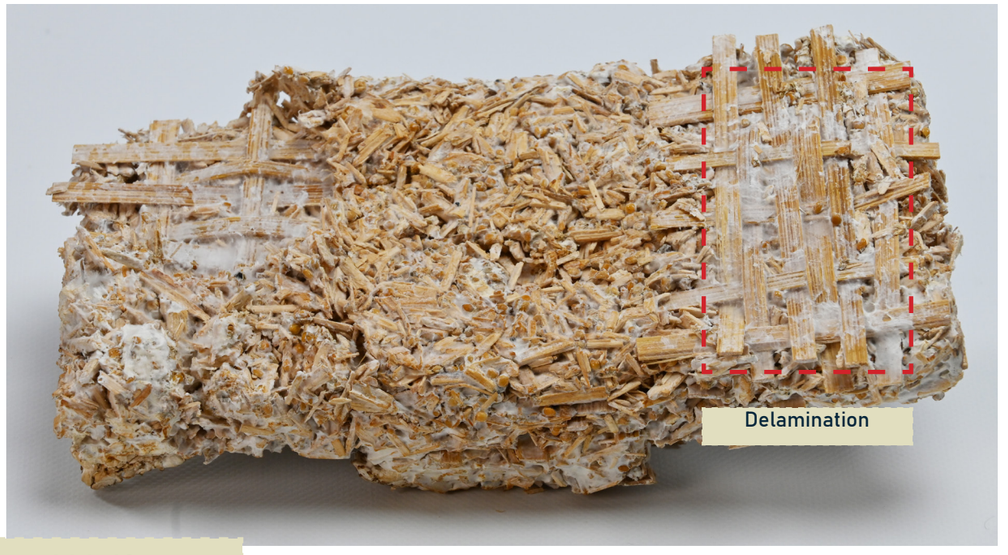
Filler blocks for parallel surfaces; Before and after

Stage	Specimen type	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength (MPa)	Density [kg/m^3]	Conditions before the test (limitations)
Stage 3 *Staggered Specimen dimensions : 190mm x 90mm x 65mm*	M06.S.I.A *(Small width 5mm, India origin type 02)*	22.303	8.74	0.511	0.616	138	early signs of delamination and incomplete growth
	M07.S.I.B *(Small width 5mm, India origin type 02)*	24.303	12.31	0.72		110	completely intact and more densely packed
	M08.S.C.A. *(Small width 5mm, China origin type 01)*	22.223	10.96	0.641		103	signs of incomplete growth around bamboo mat
	M09.S.C.B *(Small width 5mm, China origin type 01)*	20.481	8.36	0.489	0.565	171	delaminated at the leg; incomplete growth
	M10.H.00 *(Only hemp; no bamboo)*	-	-	-	-	162	Split at the leg; unsuitable for testing
Stage 2A *Specimen dimensions: 180mmx 120mm x 40mm*	L.J.I.6B *(large, joined, India origin type 02)*	19.654	18.21	0.843	0.698	-	survivor; minimum growth (refer image)
	L.J.I.6A *(large, joined, India origin type 02)*	15.727	11.92	0.552		-	survivor; very little growth (refer image)

Compression tests

Filler blocks for parallel surfaces; Before and after

Stage	Specimen type	Deformation (mm)	Fmax (kN)	Yield strength (MPa)	Mean Compressive strength (MPa)	Density [kg/m^3]	Conditions before the test (limitations)
Stage 3 *Staggered Specimen dimensions : 190mm x 90mm x 65mm*	M06.S.I.A *(Small width 5mm, India origin type 02)*	22.303	8.74	0.511		138	early signs of delamination and incomplete growth
	M07.S.I.B *(Small width 5mm, India origin type 02)*	24.303	12.31	0.72	0.616	110	completely intact and more densely packed
	M08.S.C.A. *(Small width 5mm, China origin type 01)*	22.223	10.96	0.641		103	signs of incomplete growth around bamboo mat
	M09.S.C.B *(Small width 5mm, China origin type 01)*	20.481	8.36	0.489	0.565	171	delaminated at the leg; incomplete growth
	M10.H.00 *(Only hemp; no bamboo)*	-	-	-	-	162	Split at the leg; unsuitable for testing
Stage 2A *Specimen dimensions: 180mmx 120mm x 40mm*	L.J.I.6B *(large, joined, India origin type 02)*	19.654	18.21	0.843		-	survivor; minimum growth (refer image)
	L.J.I.6A *(large, joined, India origin type 02)*	15.727	11.92	0.552	0.698	-	survivor; very little growth (refer image)



Large width 10mm
Indian origin
Best performing

Survivor from Stage 2A

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

High energy processing conditions:

- Sterilisation
- Incubation
- Thermal deactivation

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

60% reduction with Improved processing conditions:

- Sterilisation
- Incubation
- Thermal deactivation

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

60% reduction with Improved processing conditions:

- Sterilisation
- Incubation
- Thermal deactivation

Comparison to EPS & Concrete infill blocks

		Density (kg/m3)	Thermal conductivity (W/mK)	Compressive strength (MPa)	GWP-Biogenic (A1-A3) (kg CO2e/m3)	GWP-Fossil (A1-A3) (kg CO2e/m3)	Net GWP (A1-A3) (kg CO2e/m3)	Raw materials	Recyclability	Source
	Scenario A	208	0.04-0.07	1.157	-477	417.15	-59.85	Mycelium, Hemp, Bamboo	Completely biodegradable	Multiple, mentioned in text
	Scenario B (improved)				-477	330.6	-146.4			
1	Expanded polystyrene (EPS)	20	0.036	0.17- 0.33	0	60	60	Polymers, natural gas	Decades, century	Livne et al., 2022; EUMEPS EPS EPD
2	Infill concrete blocks	578	0.8	15	0	157	157	Cement, Sand	Years, decades	EPD: HH Celcon concrete block

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

60% reduction with Improved processing conditions:

- Sterilisation
- Incubation
- Thermal deactivation

Comparison to EPS & Concrete infill blocks

	Density (kg/m3)	Thermal conductivity (W/mK)	Compressive strength (MPa)	GWP-Biogenic (A1-A3) (kg CO2e/m3)	GWP-Fossil (A1-A3) (kg CO2e/m3)	Net GWP (A1-A3) (kg CO2e/m3)	Raw materials	Recyclability	Source
Scenario A				-477	417.15	-59.85	Mycelium, Hemp, Bamboo	Completely biodegradable	Multiple, mentioned in text
Scenario B (improved)	208	0.04-0.07	1.157	-477	330.6	-146.4			
1 Expanded polystyrene (EPS)	20	0.036	0.17- 0.33	0	60	60	Polymers, natural gas	Decades, century	Livne et al., 2022; EUMEPS EPS EPD
2 Infill concrete blocks	578	0.8	15	0	157	157	Cement, Sand	Years, decades	EPD: HH Celcon concrete block

Life Cycle Analysis: How much of harmful gases (C02e) does it emit?

Product stage (A1 - A3)

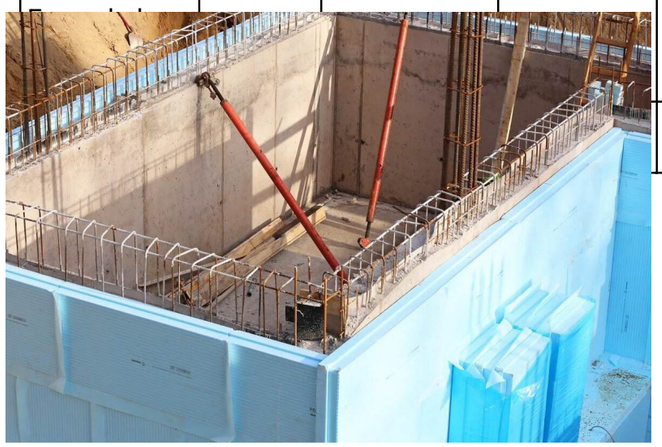
			PRODUCT STAGE : Cradle to Gate			
		Unit	A1: Raw material supply	A2: Transport	A3: Manufacturing	A1-A3 total
	(components of each process)	*all the results are per m3 production*	*(Growing + cultivation + processing) Mycelium, Bamboo, Hemp*	*China -> NL India -> NL Rotterdam -> Delft*	*Boiling + Autoclave + Inoculation + Incubation + Heat inactivation*	
Scenario A	GWP-fossil	kg Co2 e/m3	275.6	47	94.55	417.15
	GWP-Biogenic	kg Co2 e/m3	-477	0	0	-477
	Net GWP-total	kg Co2 e/m3	-201.4	47	94.55	-59.85
Scenario B	Net GWP-total	kg Co2 e/m3	-201.4	5	50	-146.4

60% reduction with Improved processing conditions:

- Sterilisation
- Incubation
- Thermal deactivation

Comparison to EPS & Concrete infill blocks

	Density (kg/m3)	Thermal conductivity (W/mK)	Compressive strength (MPa)	GWP-Biogenic (A1-A3) (kg CO2e/m3)	GWP-Fossil (A1-A3) (kg CO2e/m3)	Net GWP (A1-A3) (kg CO2e/m3)	Raw materials	Recyclability	Source
Scenario A				-477	417.15	-59.85	Mycelium, Hemp, Bamboo	Completely biodegradable	Multiple, mentioned in text
Scenario B (improved)	208	0.04-0.07	1.157	-477	330.6	-146.4			
				0	60	60	Polymers, natural gas	Decades, century	Li 20 EF
				0	157	157	Cement, Sand	Years, decades	EF co



150% carbon storage in comparison to EPS insulation panel

200% carbon storage in comparison to Concrete infill blocks

Conclusion

Thank you

Until next time,

in the Chronicles of Mycelium trying to be stronger!

We do not give up yet,

Because good things take time.