OUTLINE: COMPOSITES

WHO AM I?

WHAT IS MYCELIUM ?

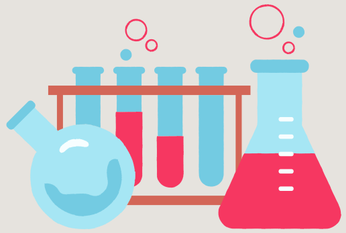
MYCELIUM COMPOSITES

WORKSHOP STEP BY STEP

ANNAH-OLOLADE SANGOSANYA

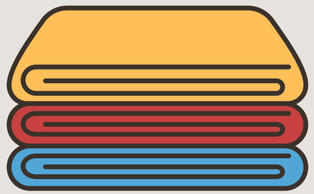
Bioengineer and textile designer

PhD at the Vrije Universiteit Brussels



M. Eng in biology (INSA Toulouse).

Specilized in microbiology, genetic engineering and fermentation processes.



Fabricademy: textile design, sustainability and technology 21/22

Focus on textile recycling, mycelium, biomaterials, 3D design and digital fabrication.

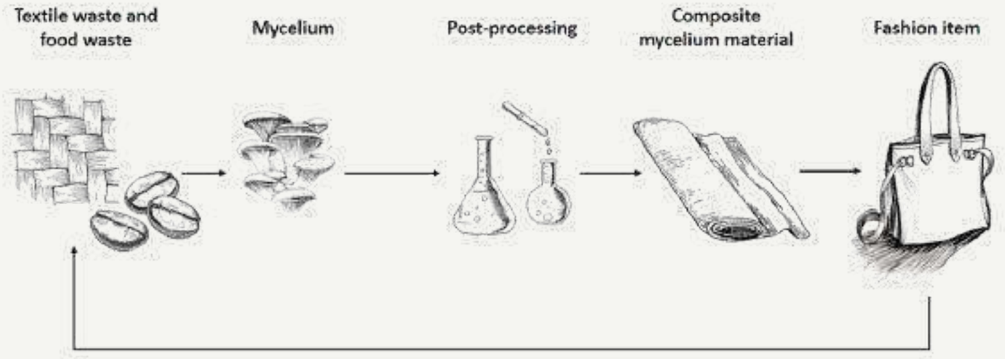
Researcher in mycelium materials and textile biodegradation.

Developpement of a mycelium materials lab in Barcelona with Jessica Dias and continuation of postgraduate thesis project into a PhD.

PHD AT VUB

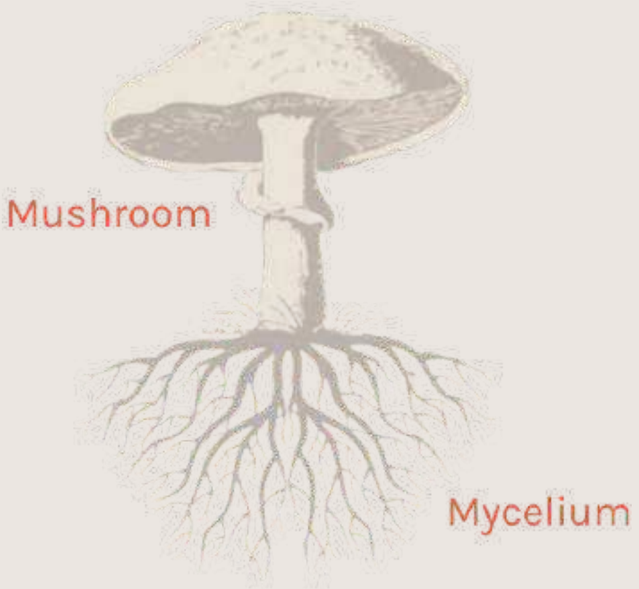
OBTENTION OF A FWO SCHOLARSHIP

Development of a PhD proposal with Vrije Universiteit Brussels from my fabricademy work on textile biodegradation using mycelium. Development of mycelium leathers and investigation of textile recycling with mycelium.



WHAT IS MYCELIUM?

“Roots” of fungi



NOT A PLANT !

Grow from the tip

If you cut it, it regrows

It's stomach is outside

Very diverse

Fungi are NOT plants, nor animals.


Mushroom Clone Petri Dish Time Lapse
PETRI DISH TIME LAPSE
Share
Watch on YouTube

MYCELIUM MATERIALS

Biobased alternatives that can be used for various materials:

- **solids**
- leather like
- foam

Ecovative - AOS designs

MYCELIUM COMPOSITES

Solid materials made from mycelium growing on a substrate

Mycelium = biological glue

Revalorization of agricultural waste

Replacement of styrofoam for packaging

Density can be increased → construction

Thermal and sound insulation properties, fireproof, antibacterial

Alea Works - Somos Mosh - Hy-Fi - MycoHab

MYCELIUM COMPOSTIE

Take home messages

Mycelium composites consist of an agriguclтural waste (the substrate) bound together by the mycelium.

Mycelium acts as a biological glue and keeps the hemp together into an object.

The object is made at the same time of the mycelium AND its food.

STRAINS OF TODAY

Oyster

Ganoderma resinaceum
“Reishi”

Ganoderma sessile

Pycnoporus sanguineus

STEP BY STEP PROCESS

Loosen the mycelium block

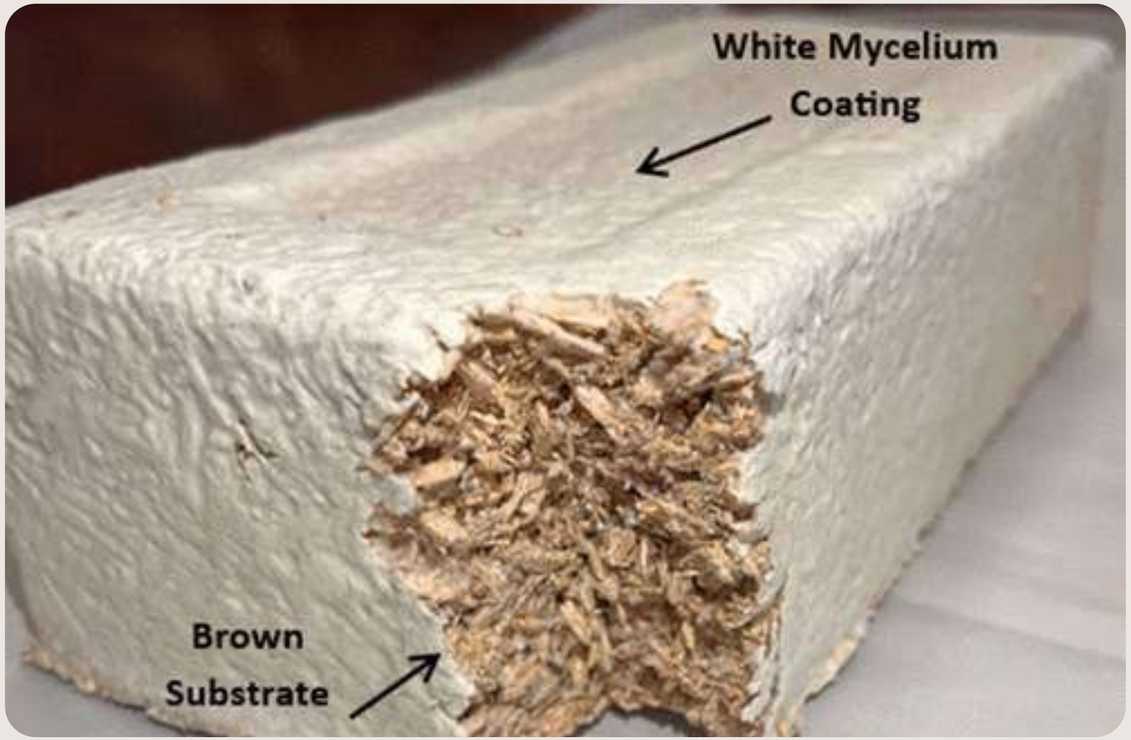
Add hemp, flour and water, and mix

Put in mold and cover

Incubation ~25°C, 1-3 days

STEP BY STEP PROCESS

Unmolding



Incubation ~25°C, 1-3 days
formation of the soft white pellicula

Drying

OUTLINE: MYCELIUM SKINS

MYCELIUM: BIOLOGY RECAP

FUNGAL SKINS: MACRO

WORKING STERILE

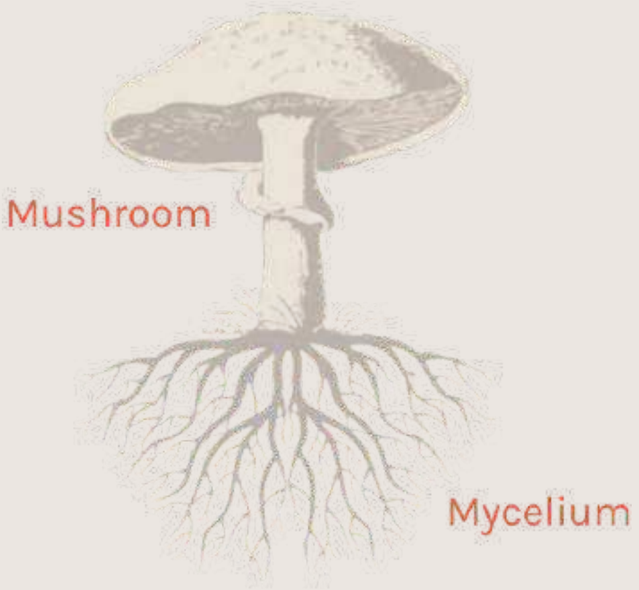
STEP BY STEP

WHAT IS MYCELIUM?

Fruiting body

“Roots” of fungi

Vegetative part



Fruiting body only appears when it wants to reproduce.

NOT A PLANT !

Grow from the tip

If you cut it, it regrows

It's stomach is outside

Very diverse

Fungi are NOT plants, nor animals.

HOW ARE MYCELIUM SKINS GROWN ?

NOT SO NEW!

Mycelium wall pockets,
1903 Alaska (Tlingit)

Mycotech Indonesia

Drying

STEP BY STEP PROCESS: AGAR PLATES

Preparing agar

20g malt extract
20g agar
1L water
20 min autoclave

Pouring petri plates

Clean the surfaces with ethanol
Working at the flame
Sterile workflow

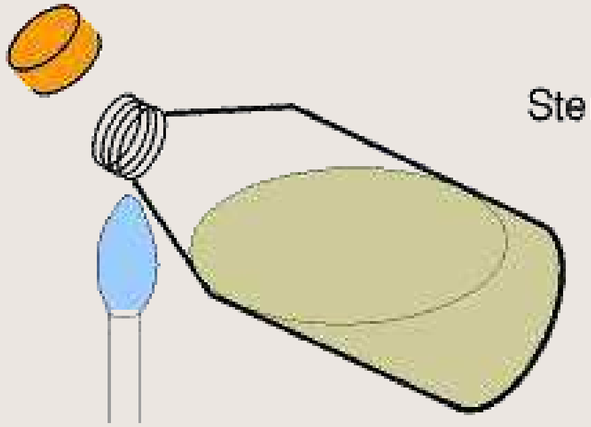
Making a transfer

Scalpel steriliation
Agar transfer

Incubation

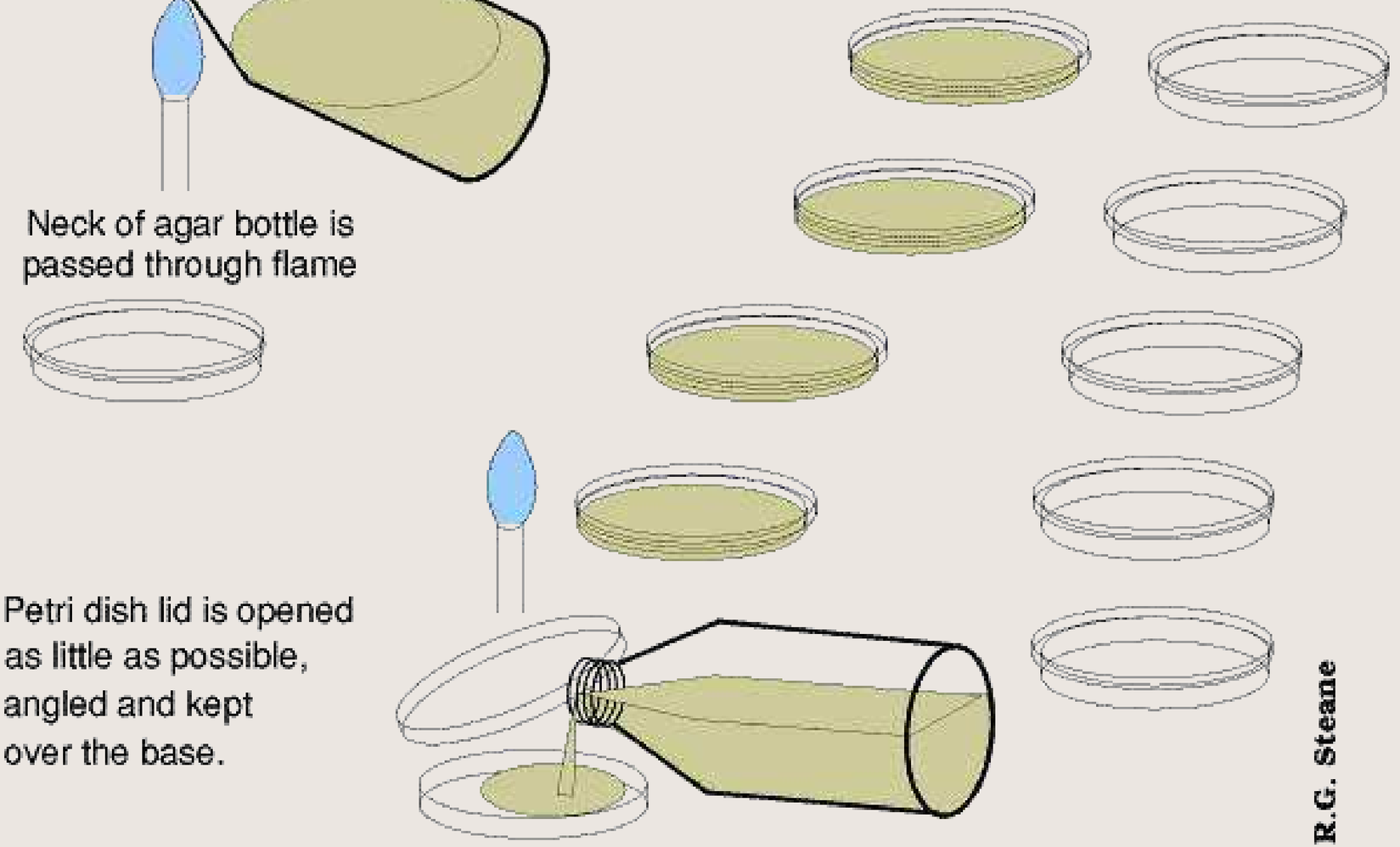
~25°C
5-8 days

"Pouring a Plate"



Neck of agar bottle is passed through flame

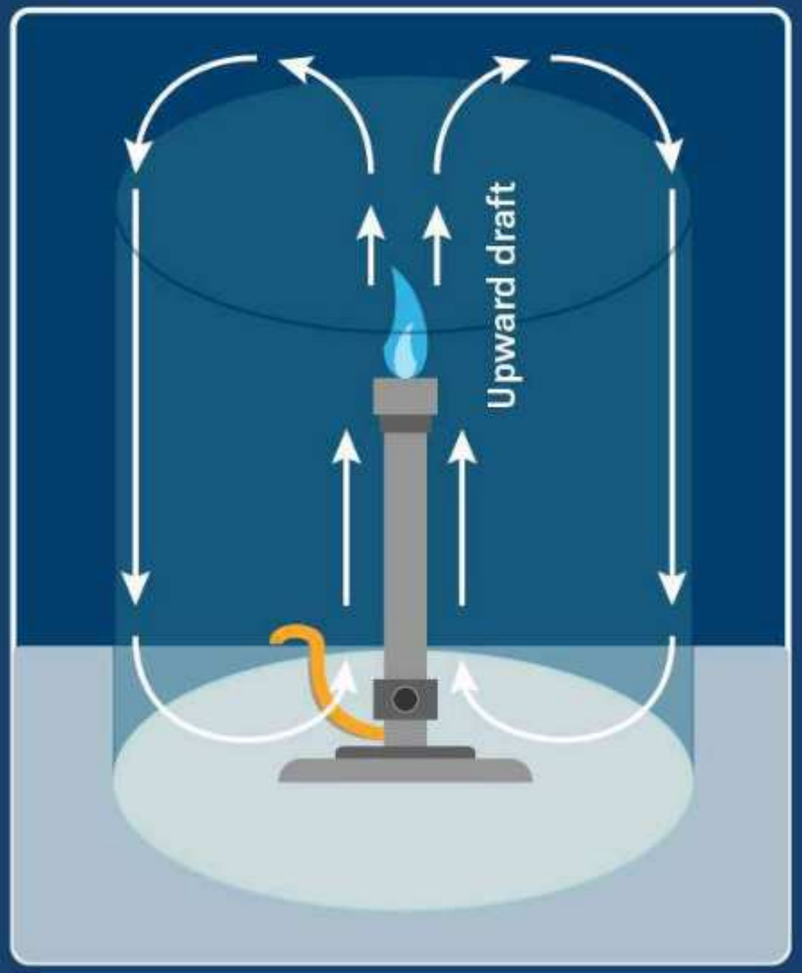
Sterilised molten agar is poured in and left to set.

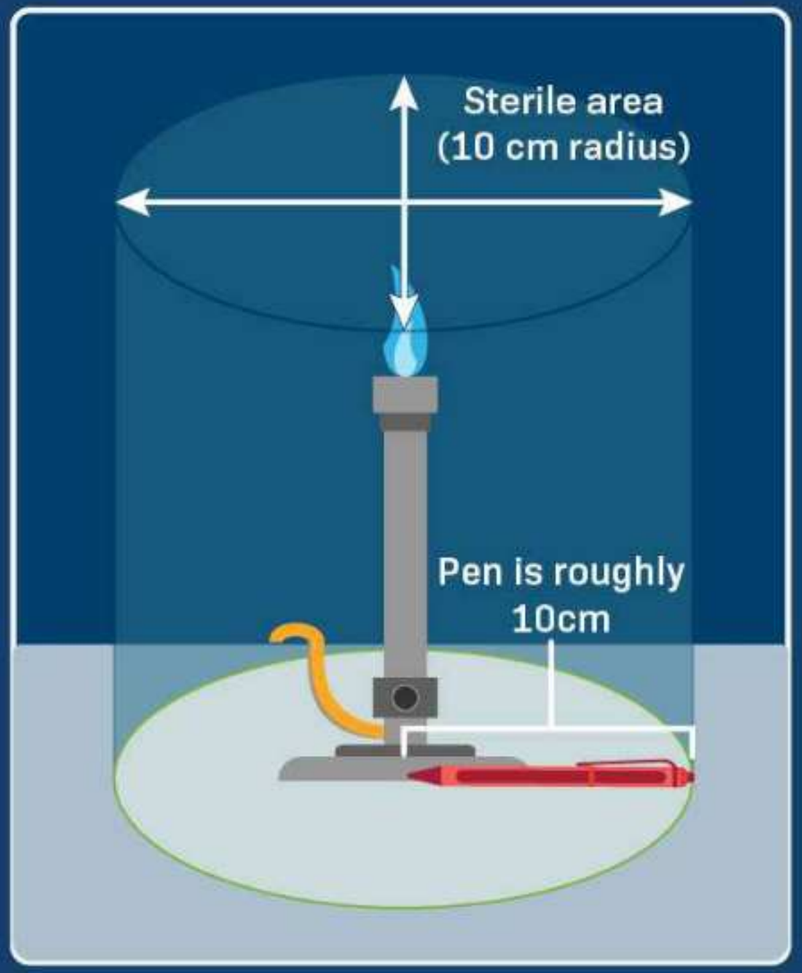


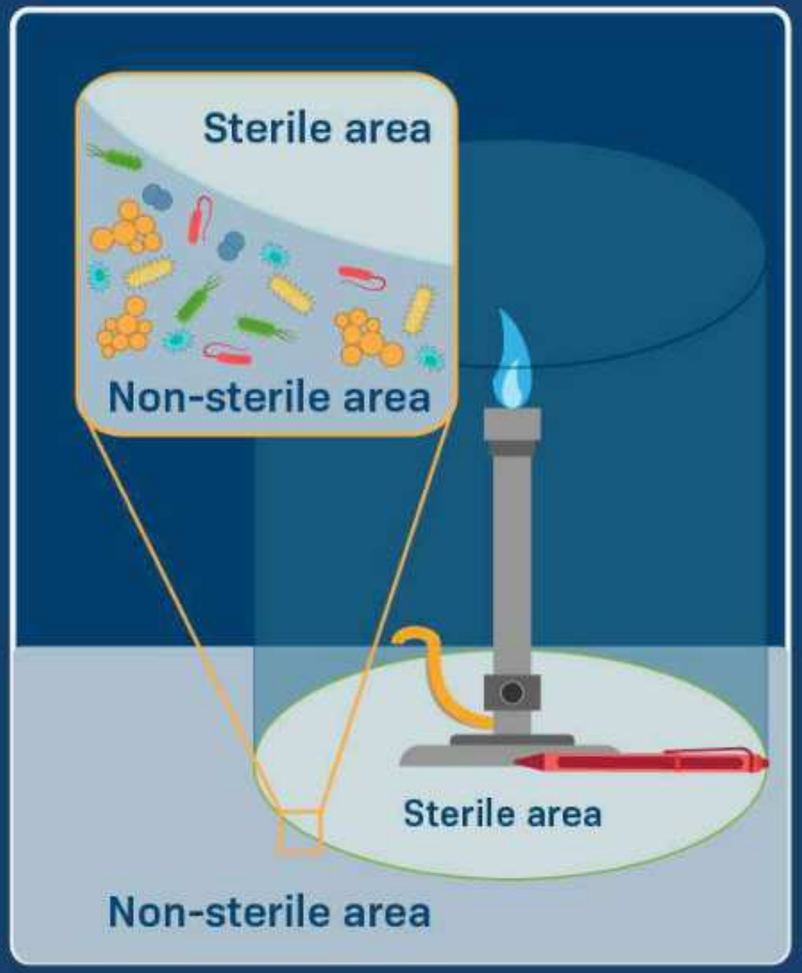
Petri dish lid is opened as little as possible, angled and kept over the base.

Each Petri dish holds about 20 ml, so 200ml will do for 10.

STERILE AREA OF THE BUNSEN BURNER







STEP BY STEP PROCESS: LIQUID CULTURE

Liquid media preparation

Malt extract broth (MEB):
20g malt extract
1L water
20 min autoclave

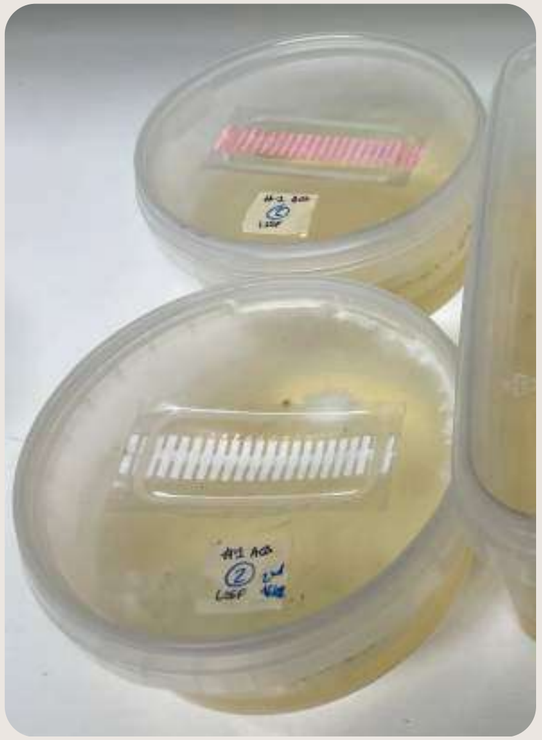
Inoculum preparation

Working at the flame
To a sterile jar with MEB, add a petri plate and blend (blender or beads method)

Liquid cultures

Working at the flame
To a box, add 100 mL MEB and some inoculum.

Incubation



~25°C
10 days minimum

STEP BY STEP PROCESS: HARVEST AND POST TREATMENT

Harvest

Rinse with water and brush

Glycerol bath

Prepare a 20% glycerol bath:
20 mL glycerol + 80 mL water
Soak for 2h

Drying

In a food dryer or in an oven,
dry the sample for 8h

Final sample

OUTLINE: MYCODEGRADATION

ECOLOGICAL ROLE OF FUNGI

MYCODEGRADATION EXAMPLES

PHD PROJECT PRESENTATION

FOCUS GROUP ORGANIZATION

ECOLOGICAL ROLE OF FUNGI

Nature’s decomposers

In nature, one of the roles of fungi is to **decompose dead matter.**

Fungi have their stomach outside, they produce units called **enzymes** capable of degrading complex compounds found in their environment in more simple ones that they can then absorb.

Fungi have evolved to produce very diverse enzymes that can degrade a wide variety of compounds, including cellulose, lignin, dyes, and even some plastics.

→ **Bioremediation**

THE PURE HYPHAE PROJECT - FABRICADEMY 2021-22

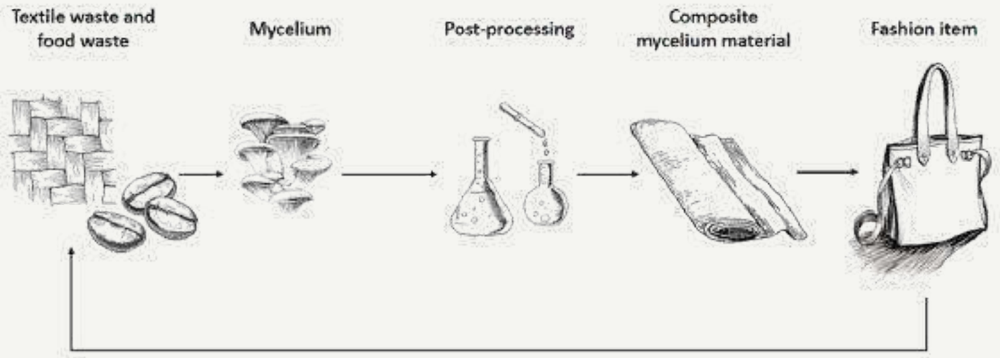
LENZING YOUNG SCIENTIST AWARD - TEXTILE RECYCLING (2022)
CRQLR AWARDS - FUNGI AND MMGH FASHION PRIZES (2022)
GREEN CONCEPT AWARD 2023 NOMINEE

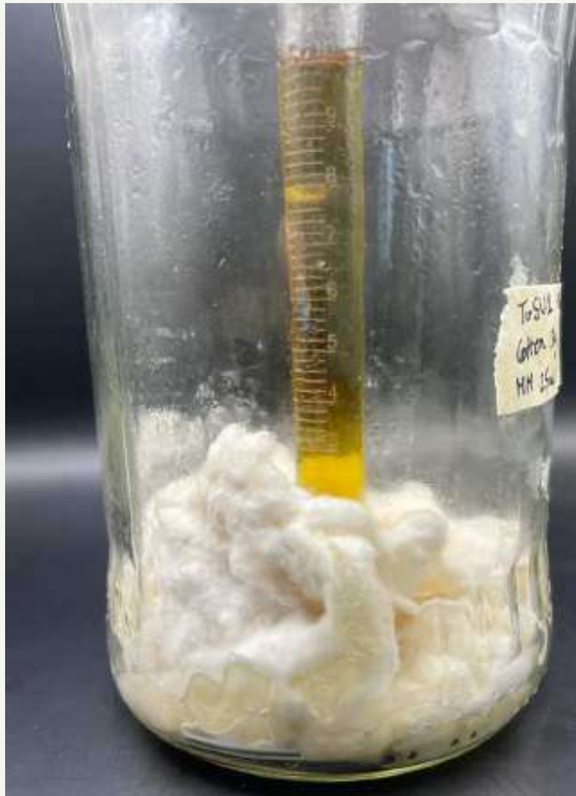
Textile waste biodegradation using mycelium, use of the material grown from it to make a composite material interesting for further fashion applications.

PhD at VUB

OBTENTION OF A FWO SCHOLARSHIP IN 2024

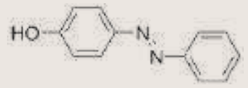
Development of a PhD proposal with Vrije Universiteit Brussels from my work on textile biodegradation using mycelium at fabricademy. Work on mycelium leathers and development of a textile recycling technique.





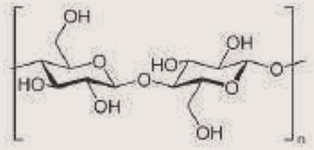
EXAMPLES OF MYCODEGRADATION

Azo dyes



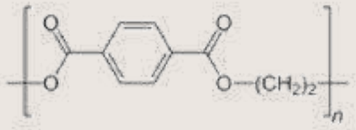
50-70% of dyes used in textile industry

Cellulose



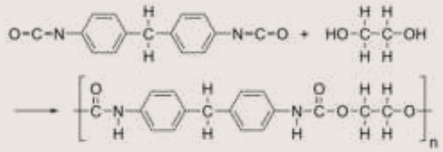
Main component of cotton, linen, hemp, rayon, viscose, tencel...

Polyester (PET)

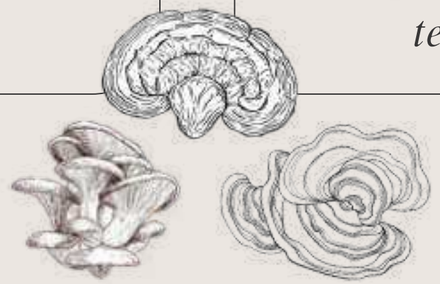


Most produced textile fiber in the world (54%)

Polyurethane



Used to make spandex, non recyclable



Not all mushrooms can degrade every toxic compound

POTENTIAL FOR TEXTILE RECYCLING AND REVALORIZATION

Mycelium as a material and as a decomposer

New purposes for poorly recycled textile waste

Soft operating conditions, low energy consumption

New material opportunities

FOCUS GROUP TIMETABLE

- 5 min — *Form groups of 2-3*
- 30 min — *From the knowledge you gained in the 2 previous workshops and during the week, come up with a concept involving textile waste, mycelium and circularity. It can (and should!) involve other machines from the green fabric*
- 11 AM — *After checking the idea with me, get to fabrication and make a prototype!*
- 2:00 PM — *Prepare a short description to present it at Maker Faire*