

# Master's Thesis about fungal biomaterials

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## The Project

### **Optimizing the fabrication and material properties of mycelium composites**

**General background:** Plastics have been ubiquitous materials in everyday human life since the latter half of the 20<sup>th</sup> century and by now they are also omnipresent in the flora, fauna, and fungi of this earth. For humans, they represent inexpensive, lightweight, and enormously versatile materials. The sustainable substitution of different plastics requires a wide variety of combinations of renewable raw materials in various forms. Mycelium-bound composites offer a possibility to produce a bio-based and biodegradable material from very inexpensive resources with similar properties as expanded polystyrene (EPS) from plant biomass and wood-degrading fungi. The mycelial filaments of the fungi interconnect the substrate particles or fibers during the manufacturing process and are later deactivated by drying. By adapting the growth process and selecting the ideal fungus-substrate combination, the properties of these materials can be tailored to certain applications such as packaging, sound absorption, or thermal insulation.

**Project context:** Different fungi are isolated from collected mushrooms and grown on various organic substrates to identify the best combinations for a certain application. The different steps of the fabrication process are constantly optimized by altering conditions such as temperature, humidity, and oxygen availability. Characterization of the products concerns mechanical stability, mycelium content, flammability, thermal conductivity, and water-related properties.

**Thesis goals:** Optimizing the manufacturing process of mycelium composites with different fungi and testing material properties of the resulting products. The optimization will be based on fabricating several layers of mycelium composites that the fungi should bind together subsequently to produce thicker materials with a higher content of mycelium.

Methods include:

- sterile culturing and handling of basidiomycetes on different media
- mechanical testing of biomaterials

## The Group

Our young and growing lab offers a unique chance to get familiar with the emerging field of fungal biomaterials using different wood-decaying fungi. Currently, three projects focus on mycelium composites enabling exchange with other PhD candidates and their students. The remaining projects in our group deal with the utilization of fungi in molecular biotechnology providing expertise in the enzymatic processes related to fungal biomass degradation.

## What we are looking for ...

- Master students in Forestry and Wood Science, Environmental Engineering, Biotechnology / Bioengineering, or similar (other curricula possible after prior consultation)
- with the desire to acquire new skills
- while taking on their own little project in a supervised environment
- experience with material engineering and testing preferred
- proficiency in English is an advantage (supervision can be German, though)

## ... and what we can offer you!

- the freedom to bring in own ideas and let your creativity flow
- and an opportunity to peek into different fundamental and applied research projects in the field of fungal biomaterials and biotechnology in our group

**If interested, please send an email including your earliest/latest possible start date, your transcript of records (and optionally your CV) to  
Marcello Nussbaumer ([marcello.nussbaumer@tum.de](mailto:marcello.nussbaumer@tum.de))**