Development of fire resistance hemp-based mycelium composites as insulation/architectural materials for green buildings.

Summary

The use of biomass such as hemp has some major drawbacks including geographical availability and durability of supply. In Estonia, there are several hemp growers, and the number keeps rising leading to the mitigation of issues related to geographical availability. Besides, other Baltic countries such as Latvia and Lithuania also contribute immensely to the European hemp market. A key issue is related to determining the most effective and valuable way to apply hemp biomass waste as a resource to develop building materials. Furthermore, compositional complexity exists. Additionally, such natural materials react with the environment under certain conditions like moisture, temperature, and odor.

Research field:	Chemical, materials and energy technology
Supervisors:	Prof. Dr. Jaan Kers Dr. Percy Festus Alao
Availability:	This position is available.
Offered by:	School of Engineering Department of Materials and Environmental Technology
Application deadline:	Applications are accepted between June 01, 2023 00:00 and June 30, 2023 23:59 (Europe/Zurich)

Description

The goal of this PhD project is to enhance fire resistance properties of hemp based mycelium composite materials to be used as insulation/architectural materials for green buildings.

Responsibilities and (foreseen) tasks:

- Characterization of the properties of the hemp biomass cultivated in Estonia and if required sourced from other regions (Latvia, Lithuania).
- Background study of fungi species for the inoculation of hemp biomass
- Investigation of the effect of the hemp biomass properties on mycelium growth.
- Investigation of product with improved resistance to fire.
- Examining the most viable, environmentally positive approach to improve the product fire performance.
- Tests related to material properties i.e., thermal conductivity, acoustic, fire reaction, moisture and mechanical performance.
- Analysis of the performance of the panels from lab to pilot scale i.e., testing in real-life applications.
- Composing comprehensive literature survey of the state of the art in the field hemp fand other natural materials based mycelium composite materials
- Publishing of the results as journal articles and conference presentations.
- Contribute to the organization of research and practitioner workshops where project findings are presented

Applicants should fulfil the following requirements:

- Master´s degree in the field of wood technology, wood science, wood chemistry or materials technology
- Familiar with methods, procedures and safety of wood technology or composite material technology, which allows to work independently
- Excellent communication skills (written and spoken) in English
- A clear interest in the topic of the position
- Strong and demonstrable writing and analytical skills
- Capacity to work both as an independent researcher and as part of an international team

- Capacity and willingness to provide assistance in organizational tasks relevant to the project

The following experience is beneficial:

- Previous experience in wood technology or natural fibre based composite materials would be highly appreciated.
- Previous experience in the most relevant characterization methods (surface roughness, contact angle measurement, tensile and flexural tests) is also expected.
- Previous knowledge about veneer-based products and their technologies.
- Working knowledge of statistics.

The candidate should submit a research plan for the topic, including the overall research and data collection strategy. The candidate can expand on the listed research questions and tasks, and propose theoretical lenses to be used.

We offer:

- 4-year PhD position in one of the largest, most internationalized and leading engineering and technology research centers in Estonia.
- Opportunities for conference visits, research stays and networking with globally leading universities and research centers in the fields of wood and natural fibers based composite materials technology and wood chemistry.

About the department

Department of Materials and Environmental Technology is an interdisciplinary research center of Tallinn University of Technology that focuses to lead the high-level, internationally recognized teaching, research and development in Estonia in the field of materials and environmental technology.

Additional information

For further information, please contact Prof. Jaan Kers: jaan.kers@taltech.ee or Dr. Percy Festus Alao: percy.alao@taltech.ee or visit the https://taltech.ee/en/department-materials-and-environmental-technology

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