

Master's Thesis Position: HumiCELL - Biomimetic Water Purification Using Controlled Humification of Lignocellulosic Biomass

Are you eager to explore nature-inspired solutions for environmental challenges? We are seeking a highly motivated master's thesis researcher to engage in groundbreaking work on developing lignocellulose-based biomimetic materials for effective water purification. The project is inspired by the role of humins in purification of ground water.

Your Role and Goals

In this thesis position, you will be instrumental in creating a novel class of humin-inspired materials for water purification through controlled humification of biomass. Your research will focus on synthesizing and structuring core-shell nanostructures with enhanced adsorption capabilities to remove waterborne contaminants efficiently.

The objectives of your work are:

- To synthesize core-shell nanostructures from lignocellulosic resources by developing a controlled, accelerated humification process that forms a nanocellulose core and a humin-like surface layer.
- To structure the synthesized core-shell nanostructures into wet stable porous adsorbent materials. The material's potential for water purification will be assessed by demonstrating a removal efficiency of at least 95% for a representative antibiotic (e.g., tetracycline).

Your research will employ acid-catalyzed dehydration for accelerated humification of lignocellulosic biomass using a gas-solid approach, focusing on hierarchical control over the core-shell structure by managing water content in biomass feedstock. Analytical techniques will include XRD, ss-NMR, FTIR, and XPS for structural analysis, and ICP-MS and LC-MS for adsorption performance evaluation.

Your Network and Team

You will be guided by Prof. Eero Kontturi and Dr. Vishnu Arumughan, who will provide support and inspire innovative solutions to research challenges. You will join the Materials Chemistry of Cellulose research group and work within the collaborative environment of the Department of Bioproducts and Biosystems. Professor Kontturi's team works on investigating basic physico-chemical phenomena that are distilled to concepts in lignocellulosic materials research. The specific research areas include cellulose-water interactions, manufacturing of nanocellulose, degradation of biomass into chemicals, biomineralization with cellulose-based hydrogels, and use of machine learning in biomass analytics and materials construction.

Your Experience and Ambitions

- Demonstrated excellence in academic coursework with a strong academic background.
- Proactive and eager to engage in hands-on laboratory work.
- Well-organized, disciplined, and capable of managing research tasks independently.
- Interested in pursuing a career in academia.

What We Offer

This five-month master's thesis position allows you to be at the forefront of sustainable materials research with significant implications for water purification technologies. Additionally, you'll have

the opportunity to co-author a scientific publication based on your findings, enhancing both your academic and professional credentials. There may also be an opportunity to continue your studies as a PhD candidate.

More Information

For further details about the role, please contact

Vishnu Arumughan: vishnu.keerakkaraarumughan@aalto.fi (room 322 PUU1 building, +358503120855)

Eero Kontturi: eero.kontturi@aalto.fi (room 327 PUU1 building, +358503442978)

We will go through applications, and we may invite suitable candidates to interview already during the application period.