Characterization of bacterial enzymes for the use in biomass conversion and lignin valorization

Summary

The aim of this PhD project is to identify and characterize novel enzymes for enhanced applications in biomass conversion as well as lignin valorization. The laboratory uses a multidisciplinary approach in the study of enzymes, combining microbiology, classical biochemistry, X-ray crystallography as well as analytical chemistry methods.

Research field:	Chemistry and biotechnology
Supervisors:	Dr. Tiit Lukk Kairit Zovo
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between May 03, 2021 00:00 and May 31, 2021 23:59 (Europe/Zurich)

Description

Lignin is the second most abundant biopolymer on earth. While lignin provides biomass with structural rigidity, due to its chemically recalcitrant nature, it also offers the plant a layer of protection against a number of natural processes that would lead to its degradation. The majority of plant biomass consists of cellulose, a polymer of β-1,4-conjugated D-glucose molecules (40-60% dry weight) but lignin content and structure in lignocellulose are highly variable, and differ from species to species in their composition and in the dry mass range (15-30%). Due to the global trend of moving away from fossil fuels and towards renewable energy sources, lignocellulose has gained much attention as a renewable resource for the production of liquid fuels (bioethanol, biodiesel) but also as a resource from which to derive alternatives to petrochemicals (lignin). There are multiple classes of organisms in nature that can degrade lignocellulose. Some of those organisms can be characterized as extremophiles – growing at elevated temperatures or extreme chemical environments. Sourcing enzymes from extremophiles for biotechnological applications is an attractive strategy in biomass valorization technologies since enzymes used in the industrial setting can benefit from: a) long term thermal stability; and b) from their ability to operate in extreme chemical environments (broad pH ranges, elevated salinity etc).

Therefore, the aim of this project is to identify and characterize novel enzymes from extremophilic organisms for enhanced applications in biomass conversion as well as lignin valorization. Codon optimized genes will be used for enzyme production from a bacterial protein expression system. The enzymes will be characterized using a multidisciplinary approach, combining microbiology, classical biochemistry, X-ray crystallography as well as analytical chemistry methods.

Applicants should fulfil the following requirements:

- Master of Science (MSc) degree in a field related to molecular biology, biochemistry or chemistry
- experience in molecular biology, protein purification and familiarity with biophysical methods will be favored
- highly motivated and proactive with excellent communication skills

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