From Fundamentals to Valorization: Enzymatic Oxidation of Cellulosic Fibres and Underlying Mechanisms (FunEnzFibres)

The project (FunEnzFibres) aims at unravelling the potential of enzymatic oxidation of cellulosic fibres for material solutions. In particular, the potential of enzymatic oxidation in sustainable fibrillation and dissolution processes for preparation of nanocelluloses and textile fibres is being studied. The biocatalytic tools explored in the project are lytic polysaccharide monooxygenases (LPMOs), which are enzymes with unique capability to oxidize polysaccharides. LPMOs can specifically oxidize cellulose and hemicelluloses, which offers totally new tools for modification of cellulosic fibres. The project is carried out by VTT Technical Research Centre of Finland Ltd, Norwegian University of Life Sciences (NMBU) and University of Natural Resources and Life Sciences (BOKU, Austria) in collaboration with a network of the industrial platform.

A number of LPMO variants for biocatalytic fibre oxidation are now available in the project, either produced by NMBU and VTT or provided by an industrial collaborator. These include LPMOs with different regioselectivity, substrate specificity and modular structure. Testing of the enzymes in fibre modifications is ongoing, revealing already interesting differences in oxidation patterns, utilizing advanced analytical methods for detection of oxidized site available at BOKU. A fascinating novel analytical tool for assessing all fibre layers stepwise, from surface to the core has been developed at BOKU for detection of oxidised groups. This has been exploited in elucidation of the enzyme penetration in the fibre structure. Production of three different types of LPMOs has been successfully scaled up, using engineered *Trichoderma reesei* and bioreactor cultivations, and grams of these enzymes are now available for application testing. The next step will be the application trials.

More information:

- Consortium Leader: Professor Kristiina Kruus, Aalto University, kristiina.kruus@aalto.fi
- Senior Scientist, Kaisa Marjamaa, VTT Technical Research Centre of Finland Ltd, kaisa.marjamaa@vtt.fi

- Consortium Website: https://www.nmbu.no/en/projects/node/38547
- Research Gate page: https://www.researchgate.net/project/From-fundamentals-to-valorization-Enzymatic-oxidation-of-cellulosic-fibres-and-underlyig-mechanisms-FunEnzFibres