Enhancing Bio-based Material Production: Characterization of a New LPMO from *Fusarium oxysporum* for Cellulose Extraction and Functionalization

Koar Chorozian[1], **Anthi Karnaouri[2*]**, **Maria Dimarogona[3]**, **Marijana Ponjavic[4]**, **Jasmina Nikodinovic-Runic[4]**, **Evangelos Topakas[1*]**

[1] *InduBioCat Group, Biotechnology Laboratory, School of Chemical Engineering, National Technical University of Athens, Athens, Greece*

[2] *Laboratory of General and Agricultural Microbiology, Department of Crop Science, Agricultural University of Athens, Athens, Greece*

[3] *Laboratory of Structural Biology and Biotechnology, Department of Chemical Engineering University of Patras, Patras, Greece*

[4] *Institute of Molecular Genetics and Genetic Engineering, University of Belgrade, Belgrade, Serbia*

E-mail: kchorozian@chemeng.ntua.gr

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Lytic polysaccharide monooxygenases (LPMOs) are increasingly recognized for their pivotal role in the breakdown of plant biomass, offering promising applications in biotechnology. This study focuses on the characterization of the AA9 LPMO from *Fusarium oxysporum* (*Fo*LPMO9A), which displays versatile regioselectivity with C1, C4, and C1/C4 oxidative cleavage patterns on cellulose substrates [1]. The research aims to harness the capabilities of *Fo*LPMO9A for biochemical and functional characterization, as well as its application for isolating and functionalizing cellulose on both micro and nanoscale levels, with nanocellulose being a green biomaterial with potential to replace plastics [2]. An enzymatic process was developed to isolate microscaled cellulose with increased crystallinity from OxiOrganosolv pretreated wheat straw biomass. Additionally, *Fo*LPMO9A was applied to functionalize bacterial nanocellulose, introducing a novel approach since LPMOs have not been previously used for bacterial nanocellulose functionalization. The efficacy of these approaches was validated through advanced nanocellulose characterization techniques and fluorescence dyes. The findings underscore the potential of employing LPMOs for enzyme-mediated isolation and functionalization of cellulose, providing a sustainable and efficient approach for producing high-added-value bio-based products from agricultural waste or fermentation products.

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