

PhD position at IFP Energies nouvelles (IFPEN) in Industrial biotechnology / Biochemistry

Towards a comprehensive understanding of reaction mechanisms of « Lytic polysaccharide monoxygenases » (LPMO) for an optimized hydrolysis of recalcitrant lignocellulose substrates

The production of bioethanol from lignocellulosic substrates depends on efficient enzymatic hydrolysis, which is one of the most expensive steps in the process. The *Trichoderma reesei* enzymatic cocktail is one of the most efficient, but certain substrates, such as softwood or Miscanthus, remain difficult to degrade with a low sugar yield. It has been shown that Lytic Polysaccharide Mono Oxygenases (LPMO) which are copper metalloenzymes are able to oxidize carbohydrates and to boost cellulase activity. However, their industrial implementation is complex, as many parameters can impact their activity and capability to enhance cellulase activity, such as the nature of the co-substrate and electron donor, regioselectivity, pH or the type of substrate. The thesis aims to identify important features of the primary structure of LPMO which influence their reactivities towards cellulose, the necessary reduction of the copper ion, and their interaction with the substrate. To this end, two wild type enzymes and several variants supposed to impact substrate affinity and reactivity will be generated and biochemically characterized. In addition, the capacity of these LPMOs to act in synergy with *T. reesei* cellulases on a real substrate will be evaluated.

As the present PhD thesis is part of a collaborative project, the enzymes will moreover be characterized by partner laboratories with expertise in biophysical methods, such as NMR, electrochemistry and EPR (electron paramagnetic resonance) as well as in theoretical modelling. This multidisciplinary approach, combining fundamental and applied aspects, will thus allow gathering complementary data to acquire essential knowledge on LPMO which is key for improvement of LPMO for industrial processes.

Keywords: cellulose hydrolysis, biofuel, cellulases, LPMO, enzymology, metalloenzyme, *Trichoderma reesei*

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PhD location	IFPEN, Rueil-Malmaison, France
Duration and start date	3 years, starting in the fourth quarter 2025 (Novembre 3)
Employer	IFPEN
Funding	PEPR
Academic requirements	Master's degree in biology or biochemistry
Language requirements	English level B2 (CEFR), Français niveau A2 (CECR)
Other requirements	Good theoretical and practical knowledge of biochemical methods and enzymology

To apply, please send your cover letter and CV to the IFPEN supervisor indicated here above.

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