4D imaging to follow deconstruction of lignocellulosic biomass and to correlate with enzymatic hydrolysis

Aya ZOGHLAMI, Christine TERRYN, Gabriel PAËS

FARE, INRA, University of Reims Champagne-Ardenne, Reims, France

PICT, University of Reims Champagne-Ardenne, Reims, France

E-mail: aya.zoghlami@inra.fr

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Lignocellulosic biomass (LB) is a renewable resource from plants, used as an alternative to fossil resources. Bioenergy, biomaterials and biomolecules can be produced based on LB without compromising global food security. However, LB is recalcitrant to enzymatic deconstruction due to its chemical composition and its structural complexity [1].

Deconstruction of the LB matrix requires physical and chemical pretreatment to increase the accessibility of polymers to enzymes and overcome the recalcitrance [2]. Until now, only some chemical and spectral features have been proposed to predict the deconstruction of LB, but these are not sufficient to understand the correlation with deconstruction efficiency. The aim of our project is to propose a novel approach to monitor the dynamics of enzymatic deconstruction of LB using fluorescence confocal microscopy to identify some structural features which can explain LB hydrolysis. It is based on the imaging of the evolution of the 3D architecture (morphological and structural) of LB in a dynamical way during the enzyme hydrolysis (4D imaging) in order to highlight the most critical structural factors that govern LB deconstruction.

[1] Zhao XB, Zhang LH and Liu DH, "Biomass recalcitrance. Part I: the chemical compositions and physical structures affecting the enzymatic hydrolysis of lignocellulose", *Biofuels Bioproducts & Biorefining*, **6,** 465-482 (2012).

[2] Sun S, Sun S, Cao X, Sun R, "The role of pretreatment in improving the enzymatic hydrolysis of lignocellulosic materials", *Bioresource Technology* **199**, 49-58 (2016).