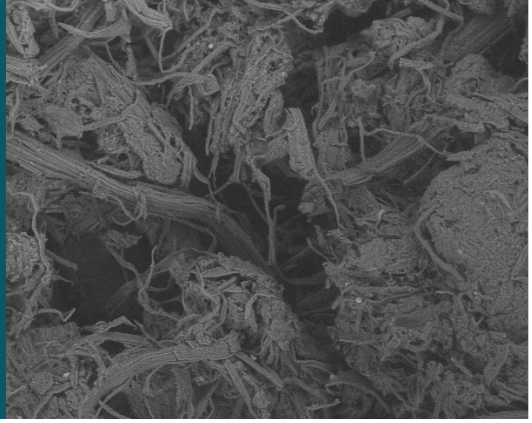

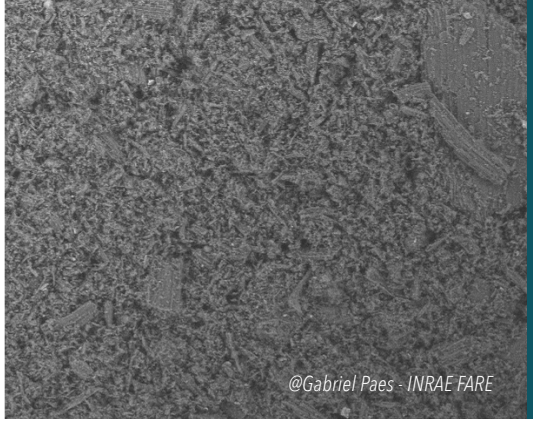

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Fungal enzymes: the key to unlock hydrolysis of plant biomass

Read more

Paës G, Navarro D, Benoit Y, Blanquet S, Chabbert B, Chaussepied B, Coutinho PM, Durand S, Grigoriev IV, Haon M, Heux L, Launay C, Margeot A, Nishiyama Y, Raouche S, Rosso MN, Bonnin E, Berrin JG

Tracking of enzymatic biomass deconstruction by fungal secretomes highlights markers of lignocellulose recalcitrance.

Biotechnology for Biofuels . 2019

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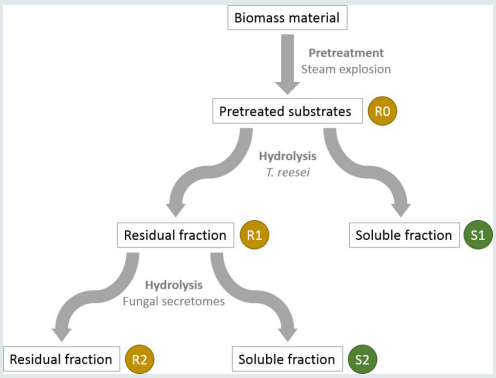
Context

The recalcitrance of plant biomass to enzymatic hydrolysis is a multifactorial problem for industry. The funded FUNLOCK project set out to identify novel enzymes to unlock the enzymatic deconstruction of plant biomass. This enzymatic hydrolysis step is one of the limiting factors strangling the current process for producing second-generation biofuels from lignocellulosic biomass. One of the first challenges set for the project was to identify markers of recalcitrance.

Results

The approach adopted was to perform structural and chemical analyses of the recalcitrant fraction before and after enzymatic treatment of various substrates in order to pinpoint and overcome the hurdles to efficient hydrolysis. The project team studied a large panel of markers in order to track and trend progress of the enzymatic reactions. They evaluated the effect of cocktails of fungal enzymes secreted by three species of basidiomycete fungi put to work on several lignocellulosic residues. Structural modifications to soluble and insoluble fractions were analyzed using spectroscopic methods and cutting-edge biophysical techniques. The fungal secretomes applied to highly-recalcitrant biomass samples expanded the window of release of remaining sugars. The correlations between these markers essentially reveal how nanometre-scale properties (polymer content and organization) influence macro-scale properties (particle size). This sharp approach has identified relevant markers of deconstruction (water sorption) to guide target-enzyme selection using multivariate analysis.



Sequential steps in fungal enzyme-driven hydrolysis of lignocellulosic biomass samples

Future Outlook

We have found these fungi but not yet uncovered all their secrets, so we need to push ahead with further investigation into their enzymatic machinery. An even deeper systematic time–course evaluation of these markers through the process of enzymatic digestion-driven deconstruction of lignocellulosic biomass will serve to develop novel enzyme cocktails for biorefineries. Tracking these markers will inform a finer-grained study into the enzymatic hydrolysis step in order to improve the second-generation biofuel production process using lignocellulosic biomass feedstocks.