Microbial conversion of lignocellulosic resources to biofuels using yeasts and bacteria :

challenges and prospects

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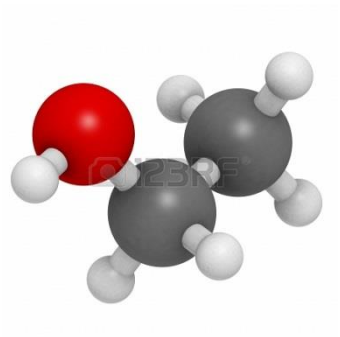
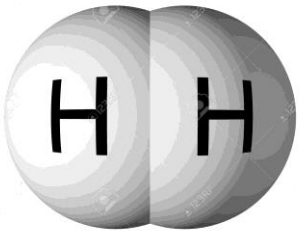
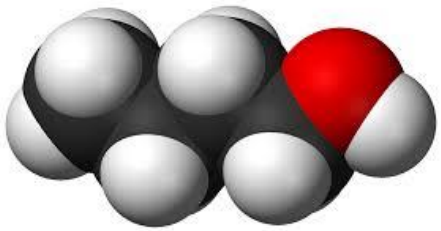
Main Biofuels

Alcohols (mainly ethanol and acetone–butanol–ethanol (ABE)), lipids as biofuel precursors, hydrogen







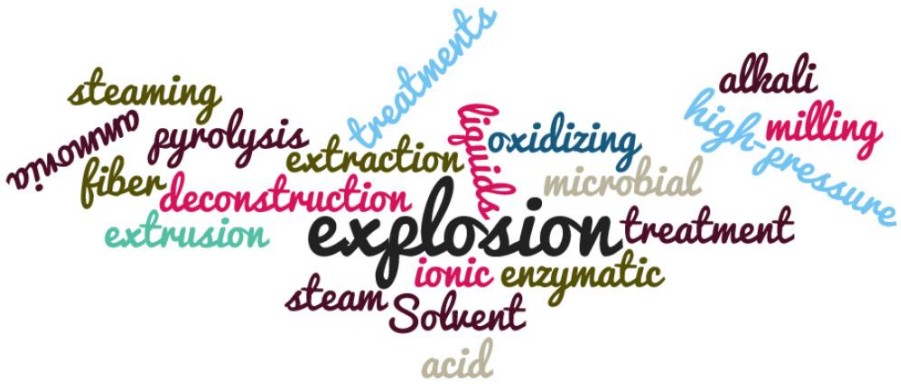
S. Alfenore, C. Molina-Jouve, Process Biochem (2016), http://dx.doi.org/10.1016/j.procbio.2016.07.028

Challenges

Biomass

Further investigate lignocellulose deconstruction mechanisms

Pre-treatment



Enhance carbohydrate release with combinations of pretreatments

Reduce energy consumption

Reduce/avoid production of toxic molecules that inhibit carbon conversion processes into biofuels

S. Alfenore, C. Molina-Jouve, Process Biochem (2016), http://dx.doi.org/10.1016/j.procbio.2016.07.028

Challenges

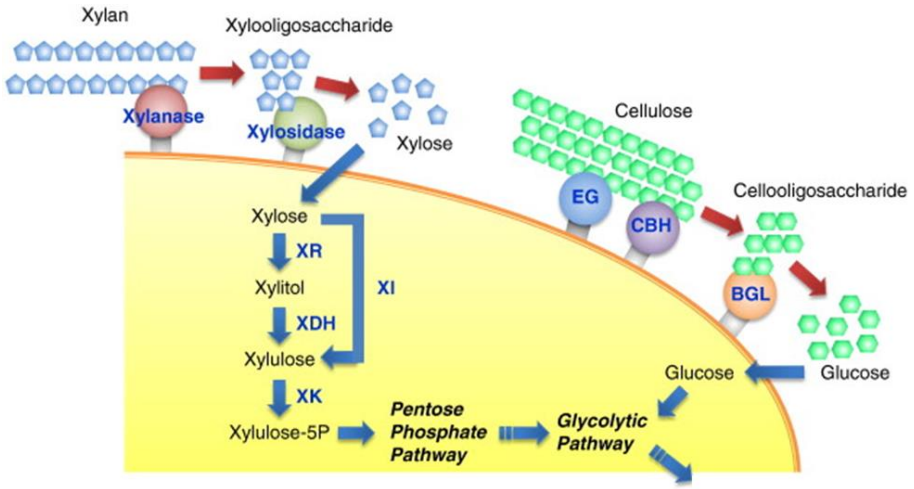
Biomass

Pre-treatment

Hydrolysis

Screen new high-performance and robust enzymes

Develop engineered enzymes and strains (consolidated bioprocessing)



Combine pretreatments and hydrolysis to improve yields at high solids loadings and to achieve economic feasibility

Develop a cleanup system to remove inhibitors

S. Alfenore, C. Molina-Jouve, Process Biochem (2016), http://dx.doi.org/10.1016/j.procbio.2016.07.028

Challenges

Few studies** on the microbial biofuel production **from real lignocellulosic substrates

Biomass

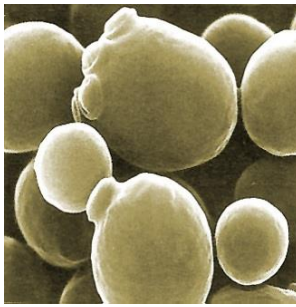
Pre- treatment

Hydrolysis

Fermentation

Increase yield and titer and productivity

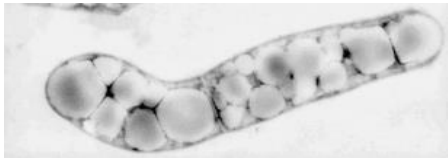
Improve cell robustness and inhibitor tolerance by using either metabolic engineering or cellular evolution/adaptation



175 – 270 kg ethanol /t corn stover
190 – 370 kg ethanol / t bagasse
144 kg ethanol / t switchgrass
200 kg ethanol / t rice straw

Khoo HH. Renewable and Sustainable Energy Reviews 2015;46:100-119.

Develop overproducing engineered strains with increased inhibitor resistance and/or excrete intracellular metabolites



Challenges

Biomass

- Pre- treatment
- Hydrolysis
- Fermentation

Improve performances (yield),
Use green solvants,
Reduce energy consumption
Innovative process

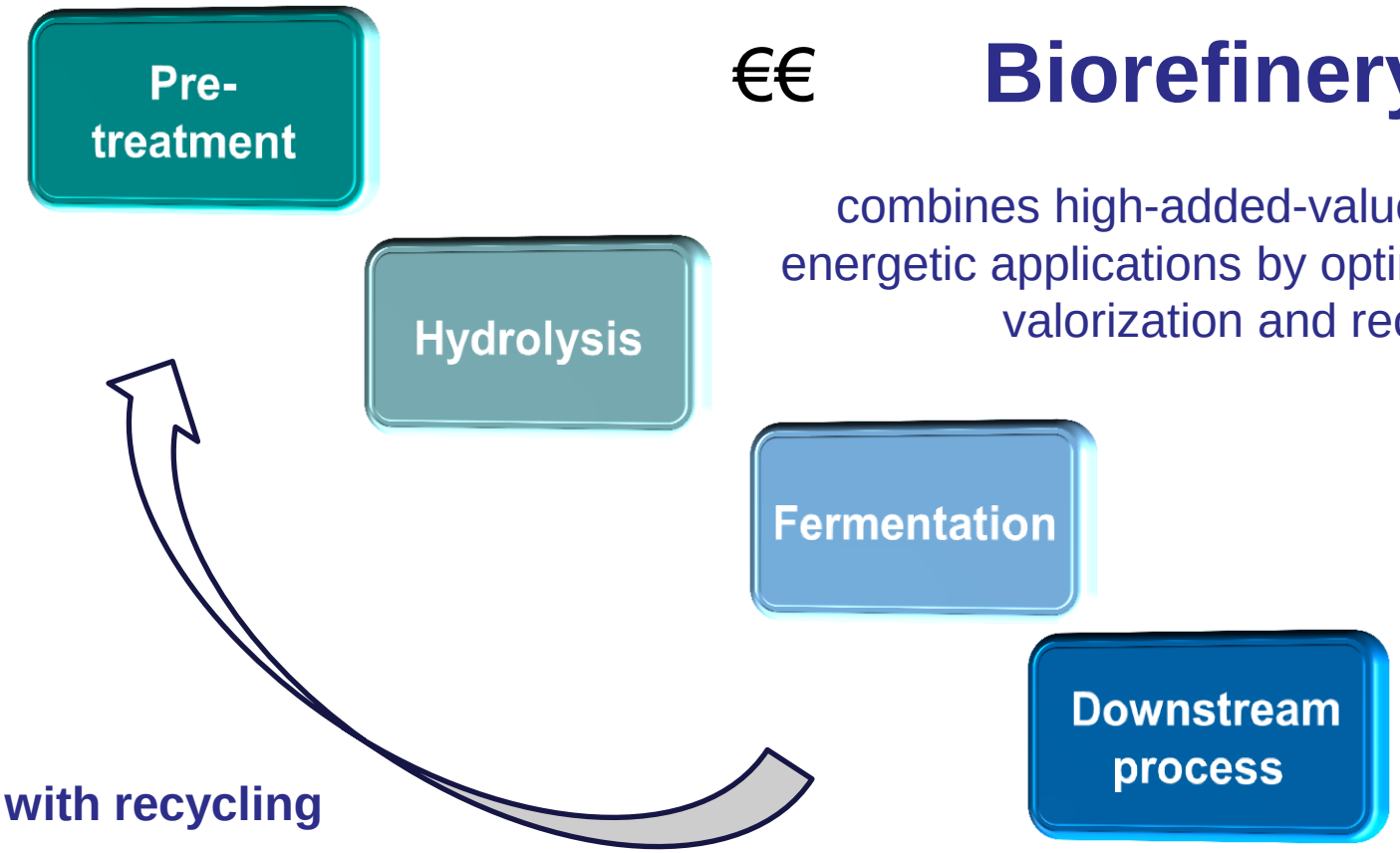
Downstream process

Biofuels

"Got a few problems going from lab scale up to full-scale commercial."

Challenges

Biomass



€€ **Biorefinery**

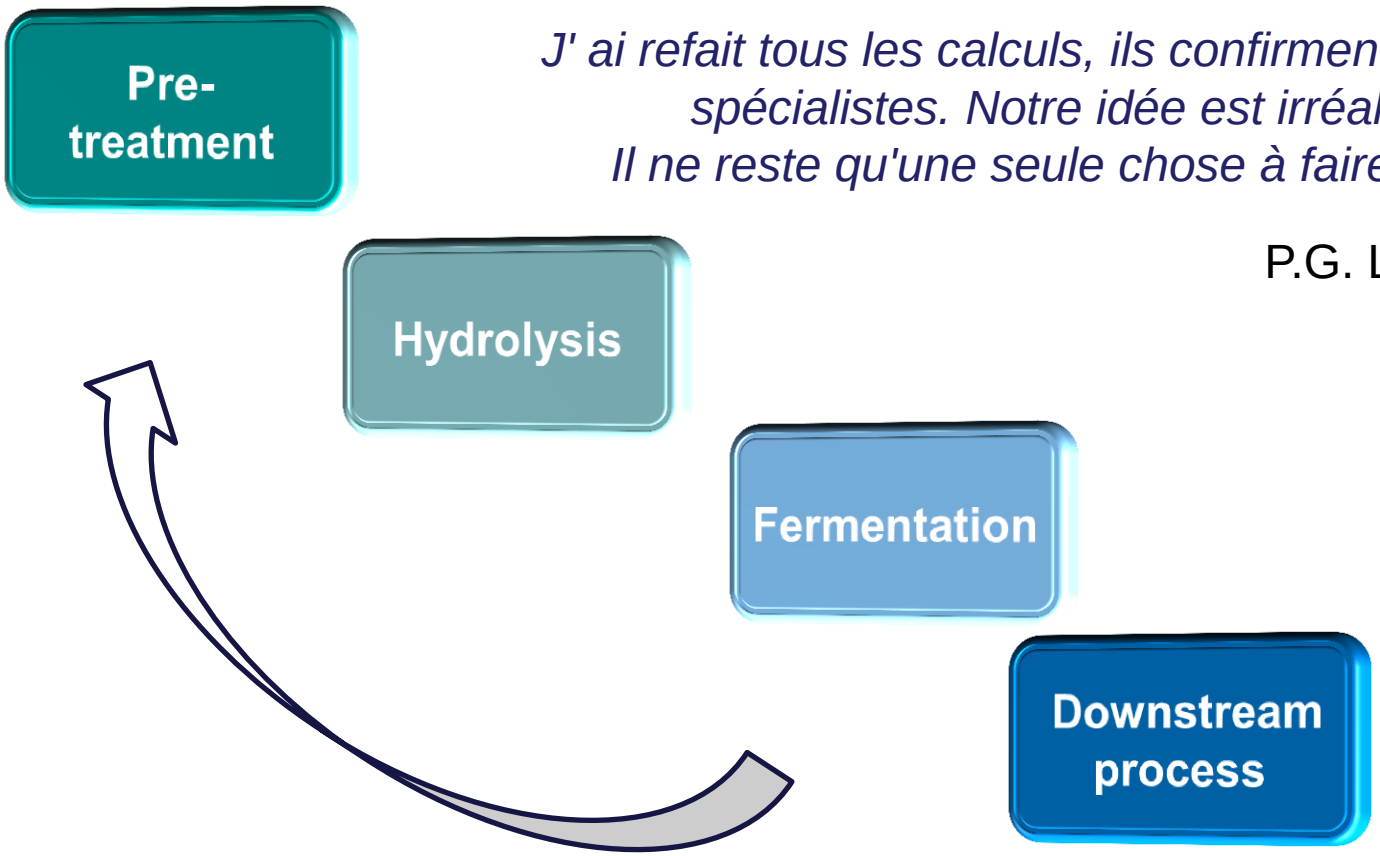
combines high-added-value chemical and energetic applications by optimizing by-product valorization and recycling.

Biofuels

And **high-added-value products**

Challenges

Biomass



J' ai refait tous les calculs, ils confirment l'opinion des spécialistes. Notre idée est irréalisable.
Il ne reste qu'une seule chose à faire : réaliser.

P.G. Latécoère (1990)

Biofuels

And **high-added-value products**

Welcome for collaborations

Some units involved