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

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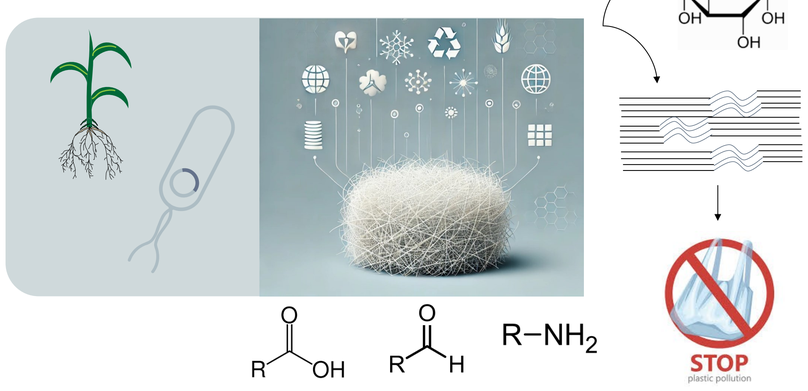
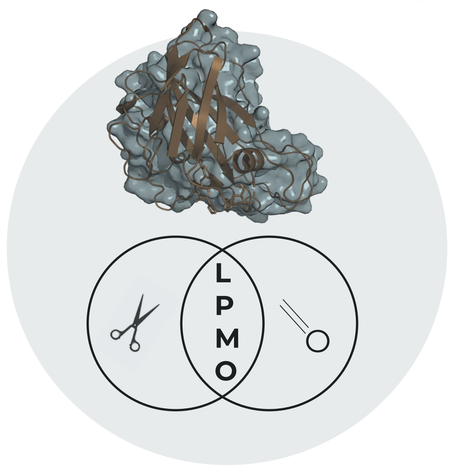
Introduction

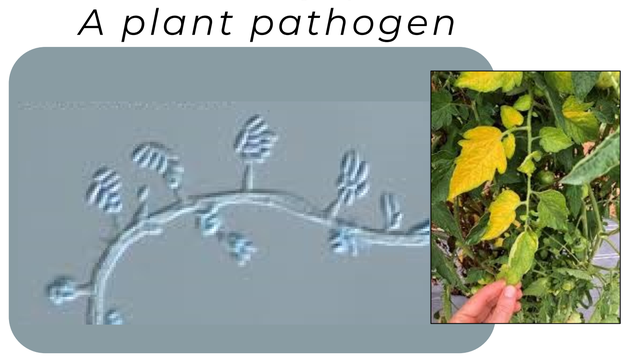
High-Value Materials from Cellulose



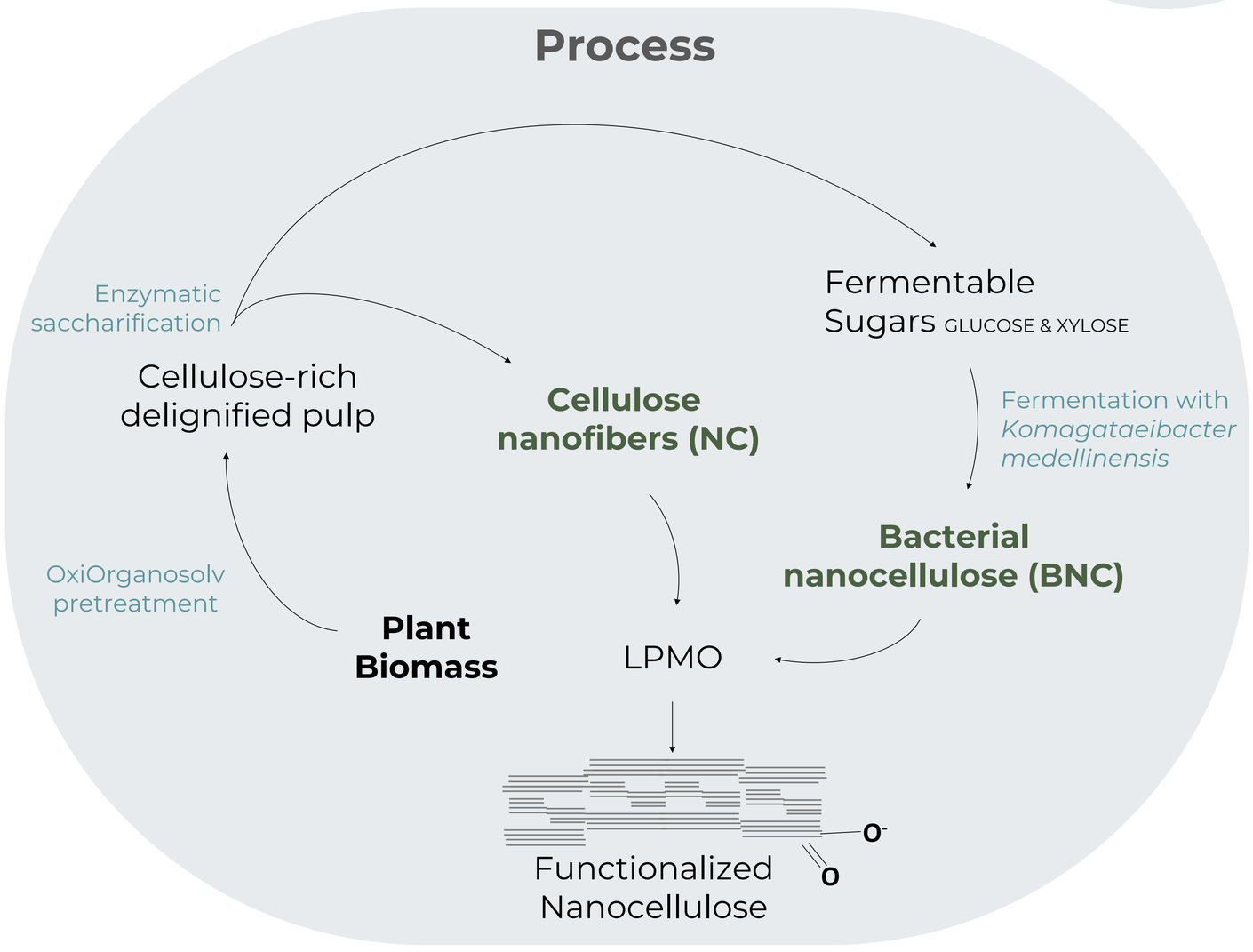
LPMOs in Lignocellulose Biomass Processing



Fusarium oxysporum: *A plant pathogen*

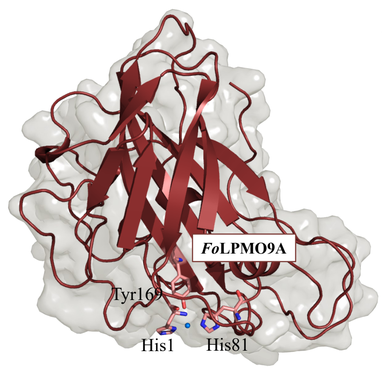


Process

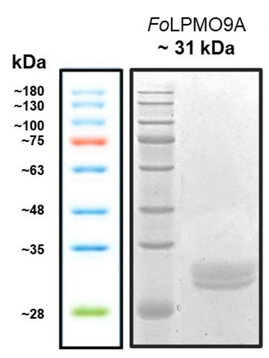


Results

3D model



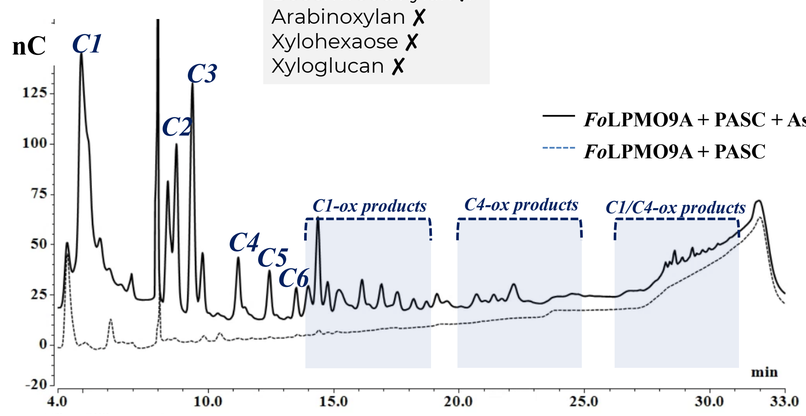
SDS gel



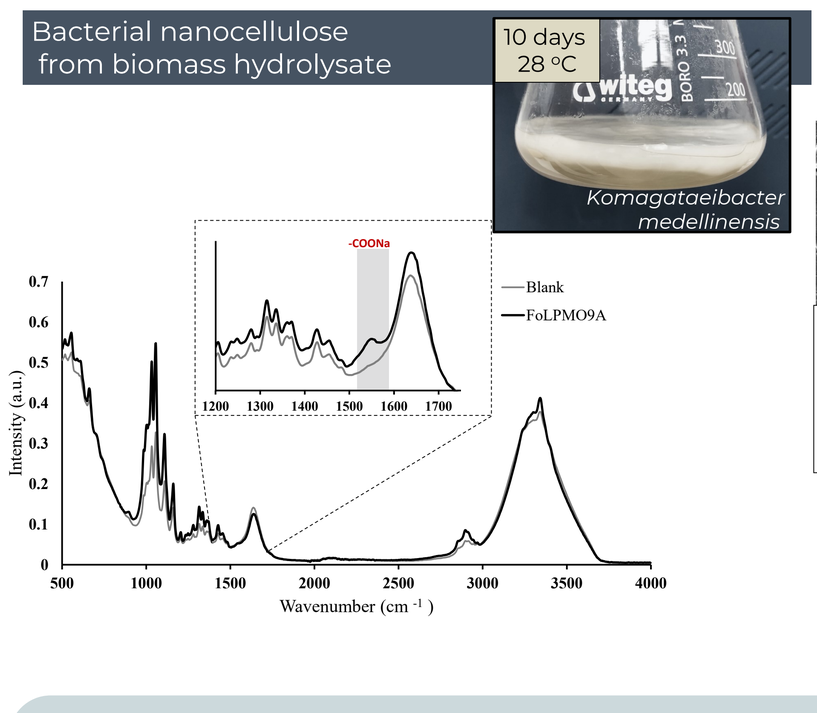
Peroxygenase activity:
Cellulose ✓
Cellohexaose ✗
Beechwood xylan ✗
Arabinoxylan ✗
Xylohexaose ✗
Xyloglucan ✗

Peroxidase activity:
2,6-DMP✓

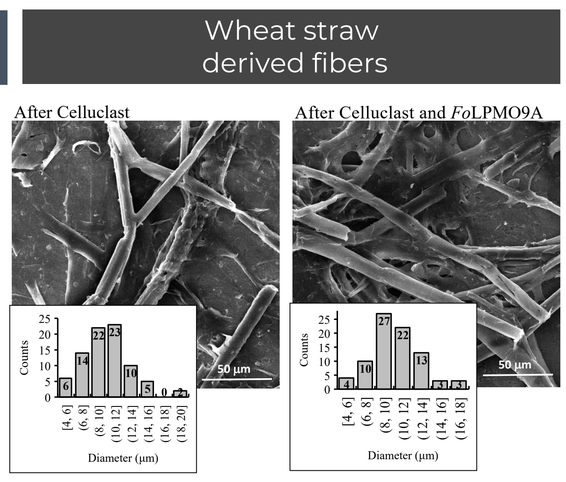
Oxidase activity:
Amplex Red✓

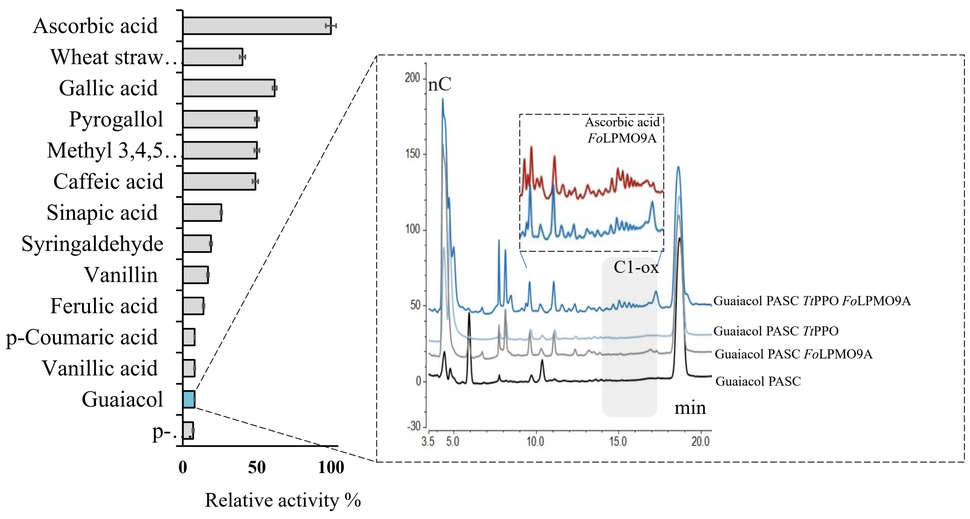


Bacterial nanocellulose from biomass hydrolysate



Wheat straw derived fibers





Conclusions

- *Fo*LPMO9A was successfully expressed and characterized. Low protein productivity was observed.
- *Fo*LPMO9A shows C1/C4 regioselectivity on cellulose.
- *Fo*LPMO9A exhibits both peroxidase and oxidase activities.
- The presence of *Tt*PPO enhances the activity of *Fo*LPMO9A in cellulose oxidation.
- *Fo*LPMO9A can be effectively applied in the production of plant-derived functionalized cellulosic materials.
- *Fo*LPMO9A successfully oxidizes bacterial nanocellulose.

Future Directions

- Leverage the synergistic / boosting effects of oxidoreductases to improve the utilization of lignocellulosic biomass for producing functionalized nanocellulose.
- Clarify the role of H_2O_2 and reducing agents in LPMO and PPO enzymatic systems.
- Promote circular economy by optimizing lignin utilization in complex processes including LPMO-mediated nanocellulose functionalization.
- Incorporate more high-yield bacterial strains into the dual-stream nanocellulose production process.
- Engineer *Fo*LPMO9A for improved stability and broader substrate specificity.

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