

# Chemical Functionalization of Plants as a Tool for the Production of Renewables Chemicals and Fuels

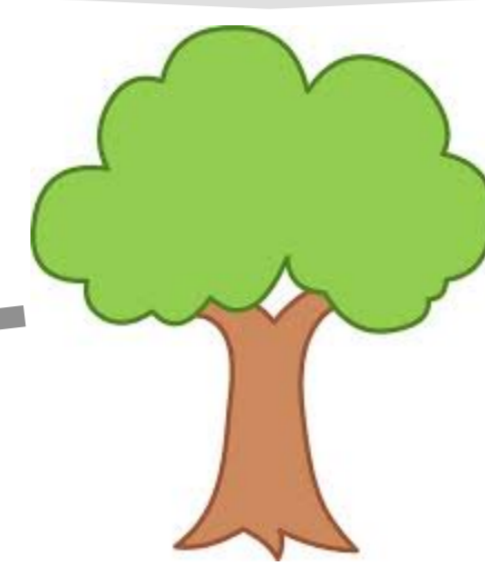
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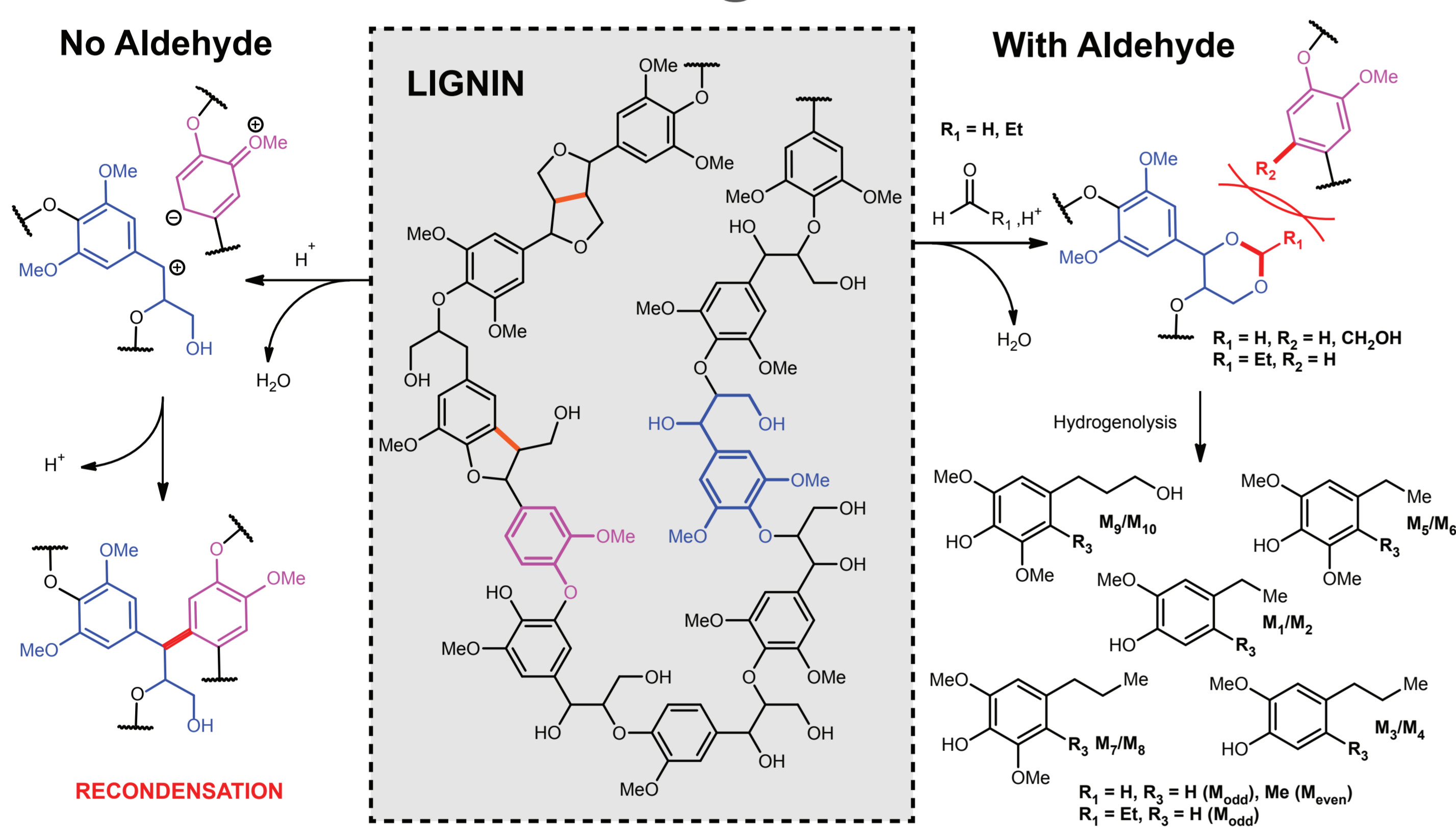
Development of a clean, economically competitive and widely available renewable energy- and carbon-source is required to supplant the current dependence of economies on unsustainable fossil resources

Agricultural- and forestry-residues arise as promising feedstocks, but the harsh conditions required to overcome their recalcitrance to hydrolysis impede their large-scale implementation

We demonstrate the application of protective chemistry during fractionation to prevent lignin recondensation and degradation products formation, paving the way to the full valorization of the lignocellulosic feedstocks

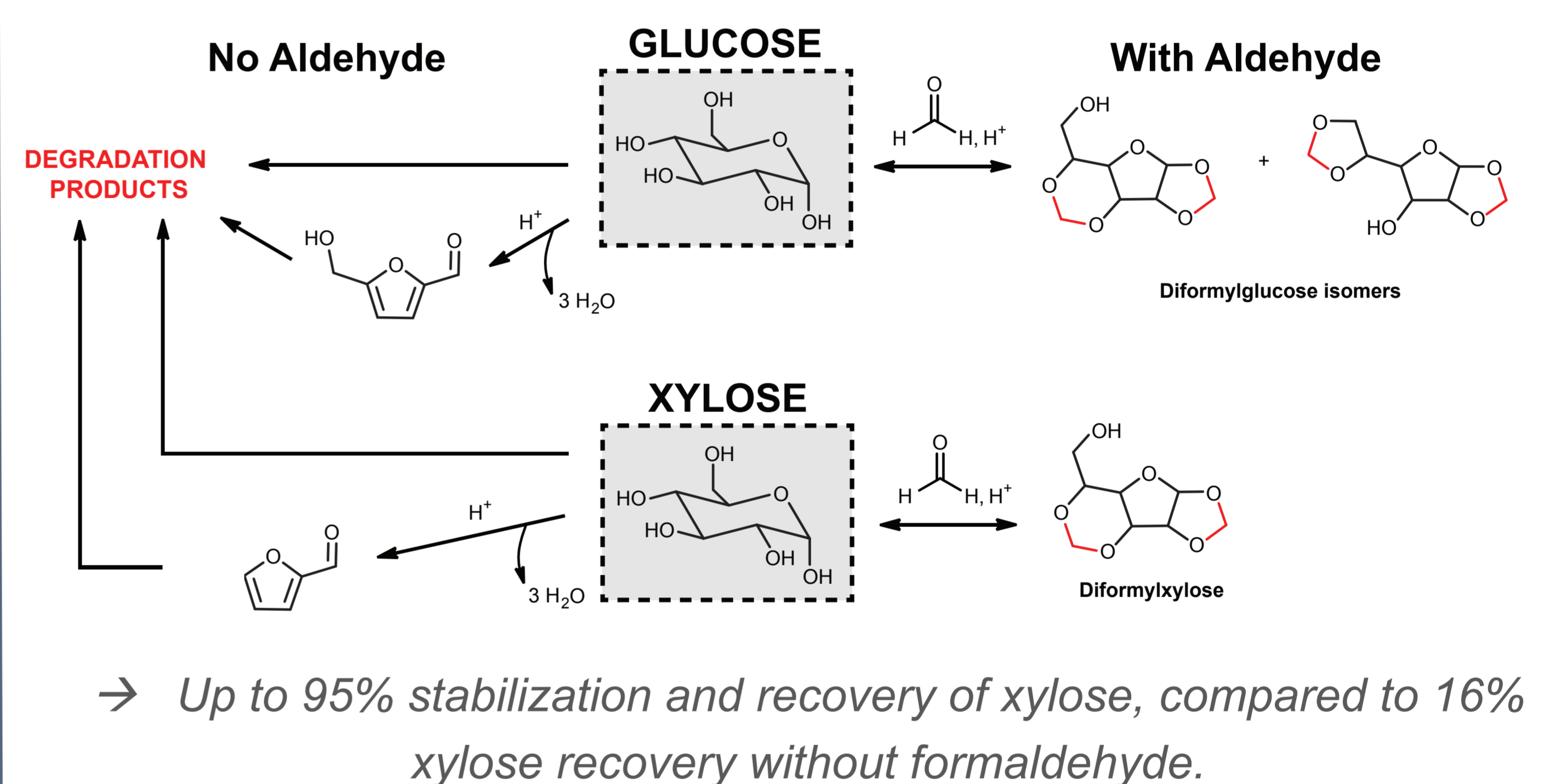


## Aldehyde-assisted stabilization of lignin

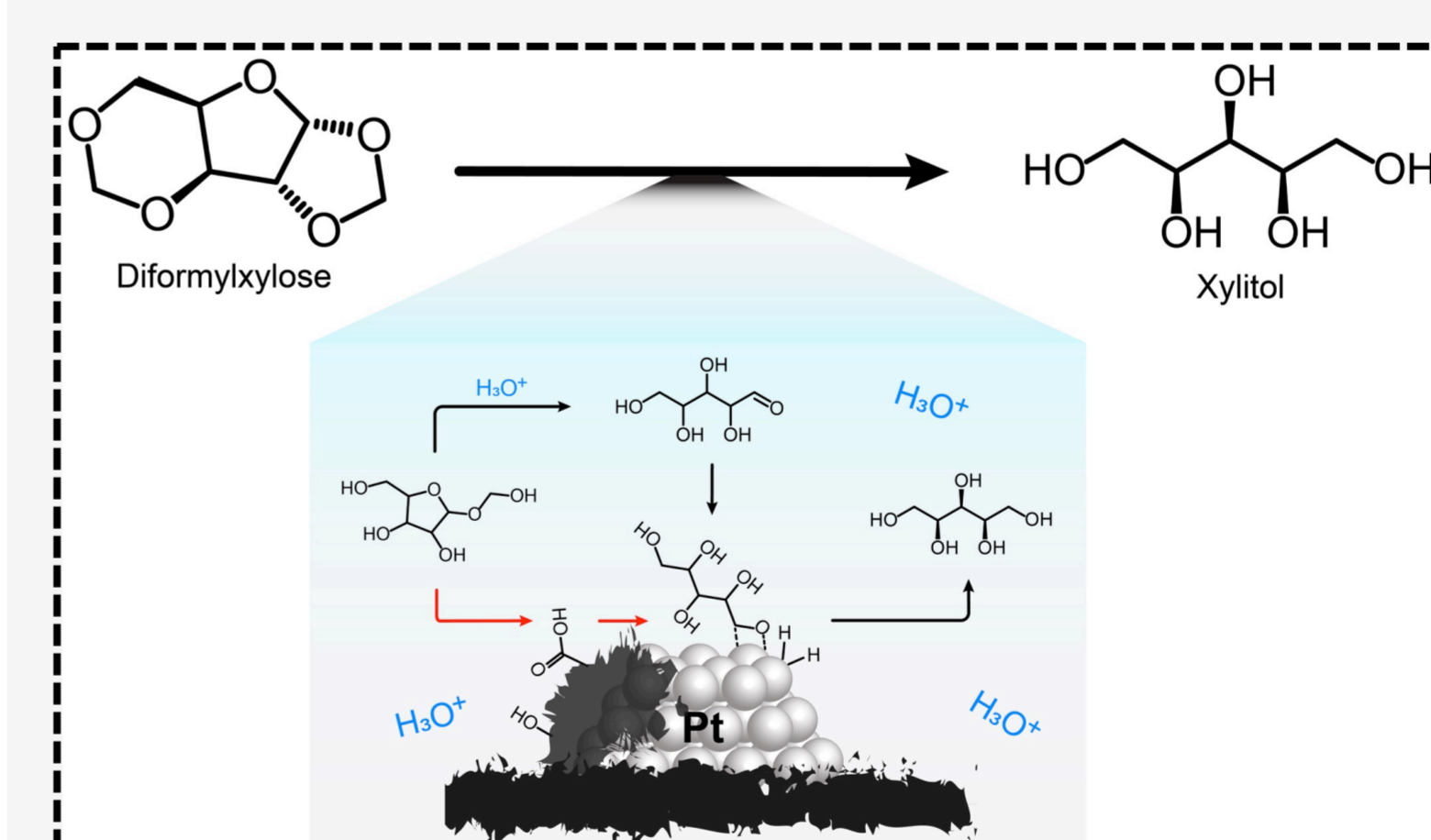


→ Catalytic depolymerisation to polymer close to theoretical yields

## Aldehyde-assisted stabilization of carbohydrates

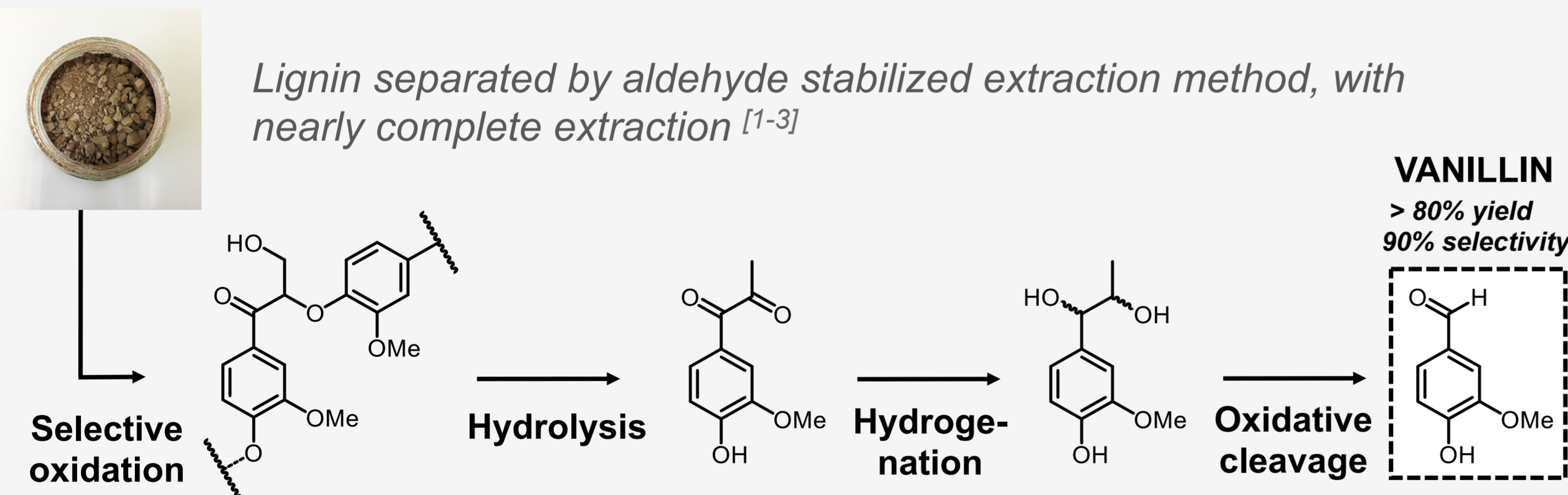


### Example of Application: Production of Xylitol from Acetal-Stabilized Xylose [5]



- Easy diformylxylose purification (volatile)
- Tandem hydrolysis-hydrogenation
- 60-71% overall yield to xylitol from xylan

### Example of Application: Production of Vanillin from Hardwood [4]



## KEY RESULT

Lignocellulosic biomass can be fully fractionated with high recovery of both structural carbohydrates and stabilized lignin/lignin monomers through the use of protective aldehydes in the fractionation step. This not only lead to a wide pool of commonly used chemicals, but also expand the actual chemical space with the creation of novel upgrading pathways.

**EPFL**

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### References

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- [3] M. T. Amiri, G. R. Dick, Y. M. Questell-Santiago, J. S. Luterbacher, *Nat Protoc* 2019, 14, 921-954.
- [4] W. Lan, J. B. de Bueren, J. S. Luterbacher, *Angew Chem Int Edit* 2019, 58, 2649-2654.
- [5] Y. M. Questell-Santiago, J. Yeap, M. T. Amiri, B. P. Le Monnier, J. S. Luterbacher, *ACS Sustain Chem Eng* 2020, 8, 1709-1714.

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