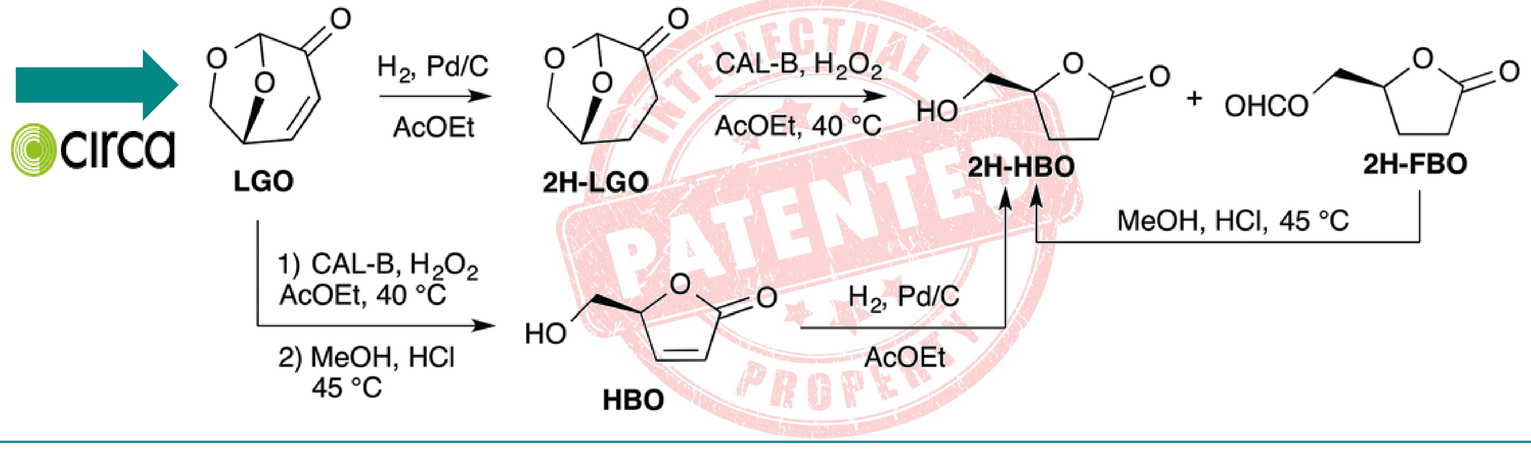
Chemo-enzymatic synthesis of key intermediates (*S*)-γ-hydroxymethyl-α,β-butenolide and (*S*)-γ-hydroxymethyl-γ-butyrolactone *via* lipase-mediated Baeyer–Villiger oxidation of levoglucosenone

Amandine L. Flourat[a,b], Aurélien A. M. Péru[a,b], Andreia R. S. Teixeira[a,c], Fanny Brunissen[a,b], Florent Allais[a,d]*

[a] AgroParisTech, Chaire Agro-Biotechnologies Industrielles (ABI), F-51100 Reims, France
[b] AgroParisTech-INRA, UMR 1318 IJPB, F-78026 Versailles, France
[C] AgroParisTech-INRA, UMR 1145 GENIAL, F-91744 Massy, France
[d] AgroParisTech-INRA, UMR 782 GMPA, F-78850 Thiverval-Grignon, France

florent.allais@agroparistech.fr

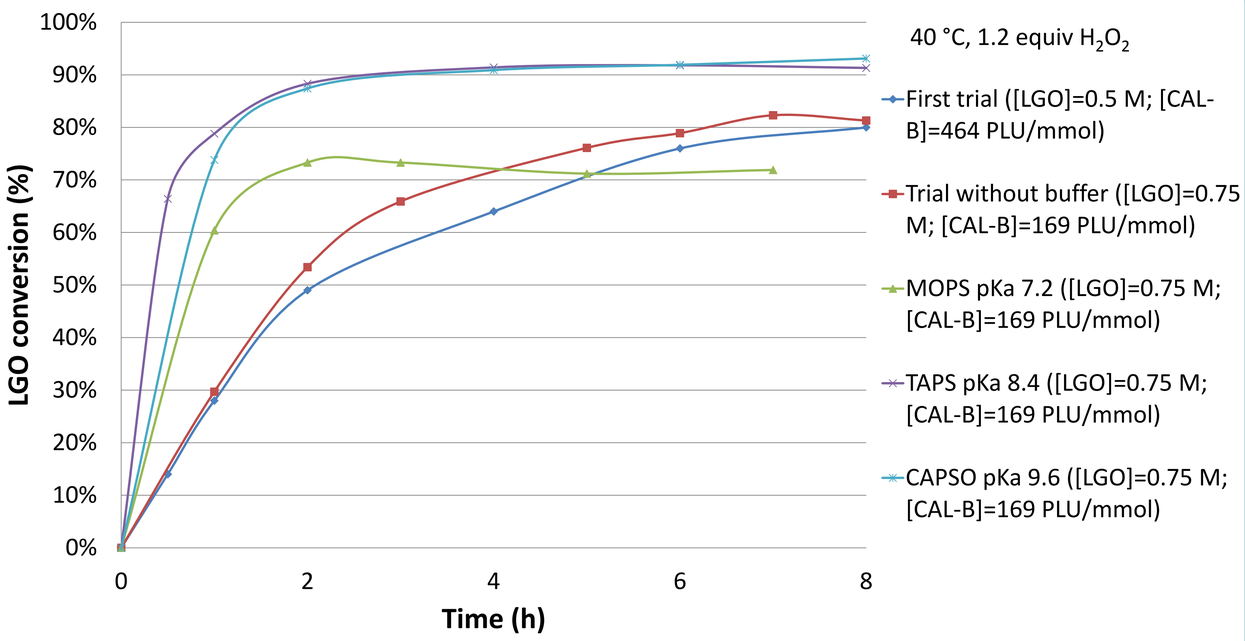
Cellulose



Key factors for Green Synthesis

- Cellulose-derived subtrate
- Enzymatic catalyzis
- Bio-based solvent

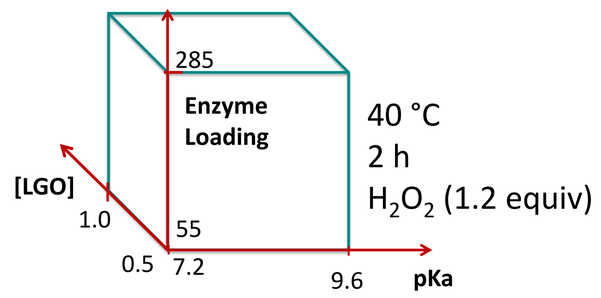
Kinetic of the Baeyer-Villiger oxidation



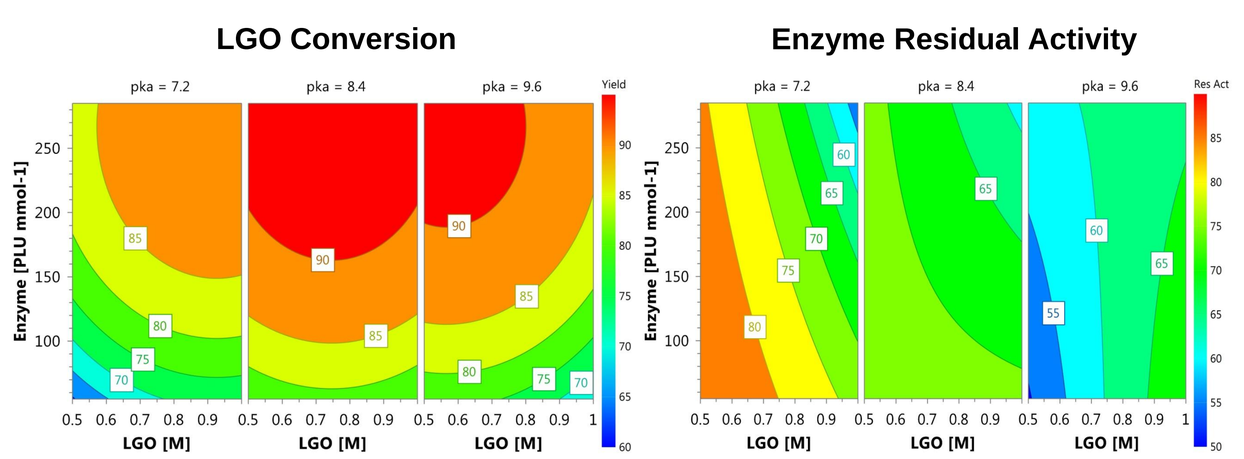
Without buffer → Optimal conversion in 8 hours
With solid buffers → Optimal conversion in 2 hours

Four-fold decrease in reaction time

Optimisation by Design of experiments

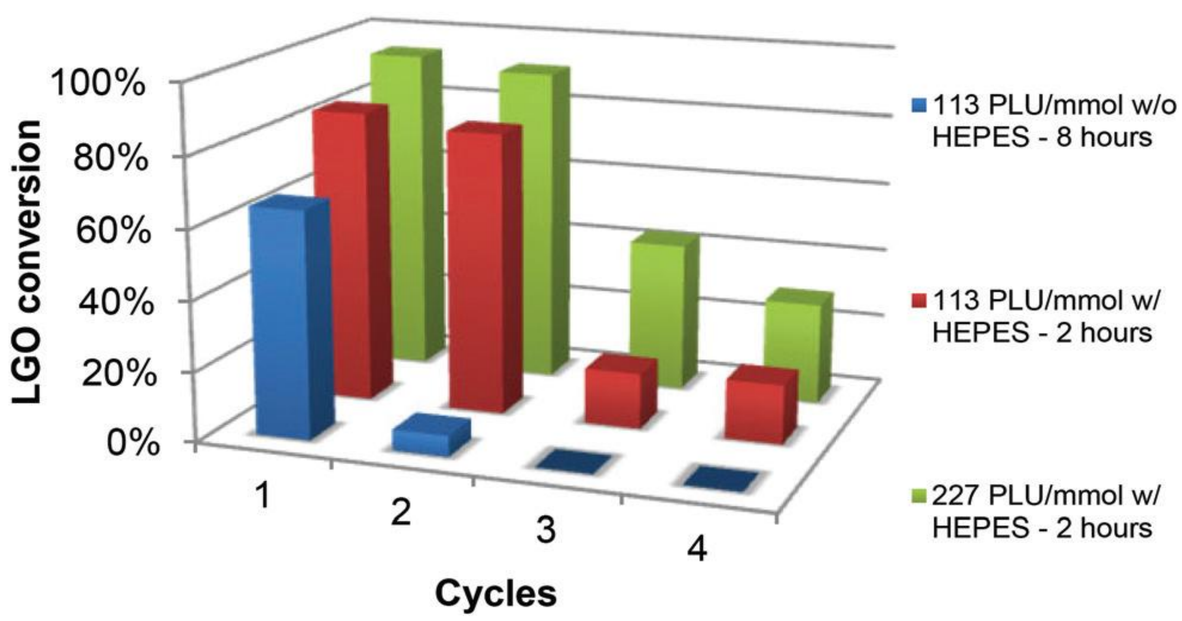


Studied responses
- **LGO** conversion
- Enzyme residual activity



Antagonist behavior → Compromise between yield and enzyme reusability

Recyclability



Without solid buffer → No recyclability
With solid buffer → **2 cycles** with 113 PLU.mmol^{-1}

Attaining for Optimal Conditions

Objectives
- Conversion > 80%
- Residual activity > 75%
- Minimize enzyme load

Conditions
- pKa 7.5 => HEPES
- [**LGO**] = 0.75 M
- [CAL-B] = **113** PLU.mmol^{-1}

Four-fold decrease of enzymatic loading

Conclusions

✓ Lipase-mediated Baeyer–Villiger oxidation has been successfully applied to convert **LGO** into **HBO** and **2H-HBO**

✓ Use of solid buffers:
- shortens the reaction time from 8 to 2 hours
- cuts the enzymatic loading by four
- allows the reuse of enzyme for a second cycle without significant loss of activity

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Lipase-catalyzed Baeyer-Villiger Oxidation of cellulose-derived Levoglucosenone into (*S*)-γ-hydroxymethyl-α,β-butenolide: Optimisation by Response Surface Methodology. A. R. S. Teixeira, A. L. Flourat, A. M. M. Peru, F. Brunissen, F. Allais* *Submitted*