Continuous and long-term electricity-driven production of acetate from CO_2 using a mixed microbial community

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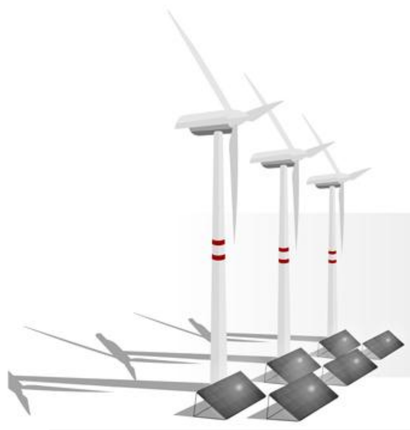
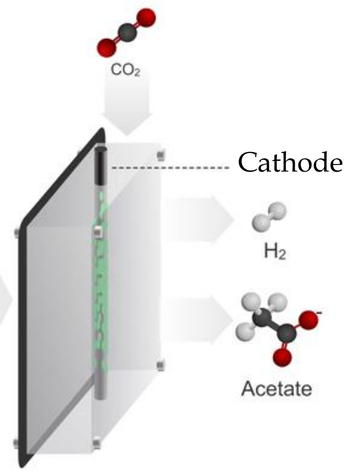
MICROBIAL ELECTROSYNTHESIS

Excess renewable power



Wind & solar power

Bioelectrochemical conversion into storable chemicals



Enrichment strategy for inhibiting methanogenesis

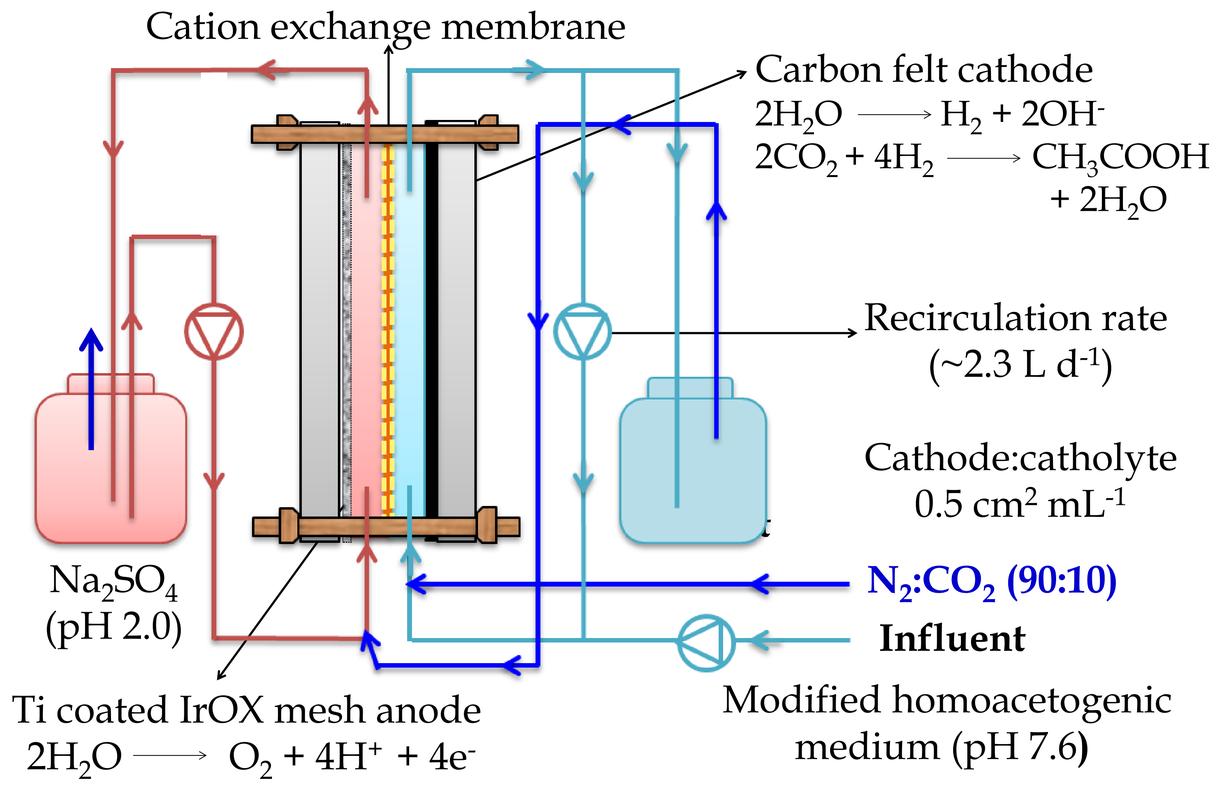
Reproducible and stable performance by the microbial community

Rapid start-up of bioproduction

Potentiostatic OR **Galvanostatic operation (-5 A/m²)**

- Low acetate titer (poor mixing and cathode to catholyte ratio)
- pH decrease (<6.0)

EXPERIMENTAL



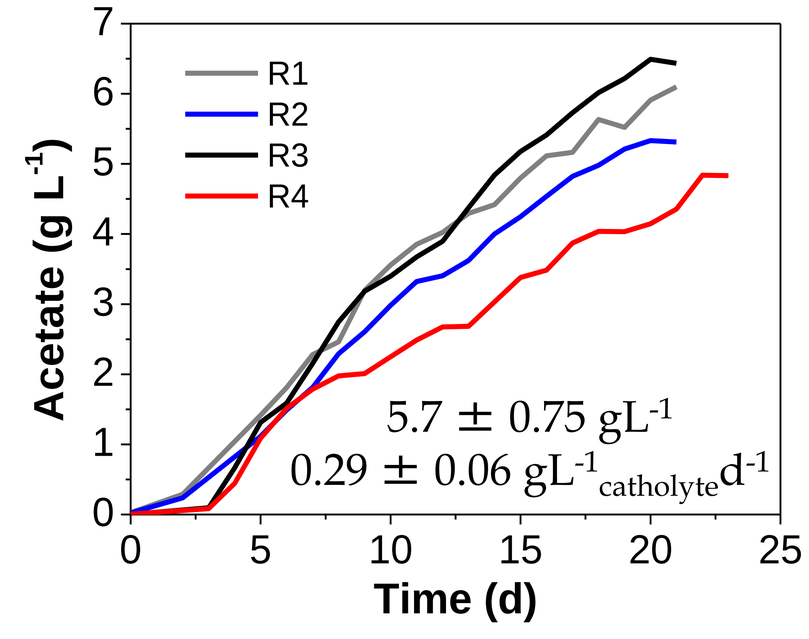
Microbial inoculum: Enriched mixed culture at autotrophic conditions (Patil et al. EST 2015 LabMET)

OBJECTIVES

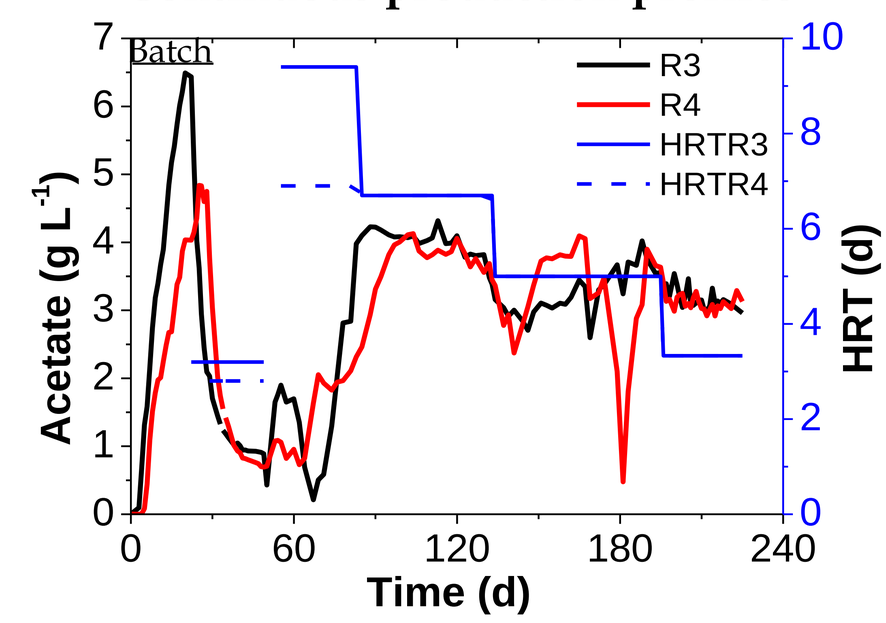
- Improve the cathode:catholyte ratio and mixing in reactors in order to improve the acetate titer and production rates
- Investigate the continuous and long term MES platform for CO_2 to acetate

RESULTS

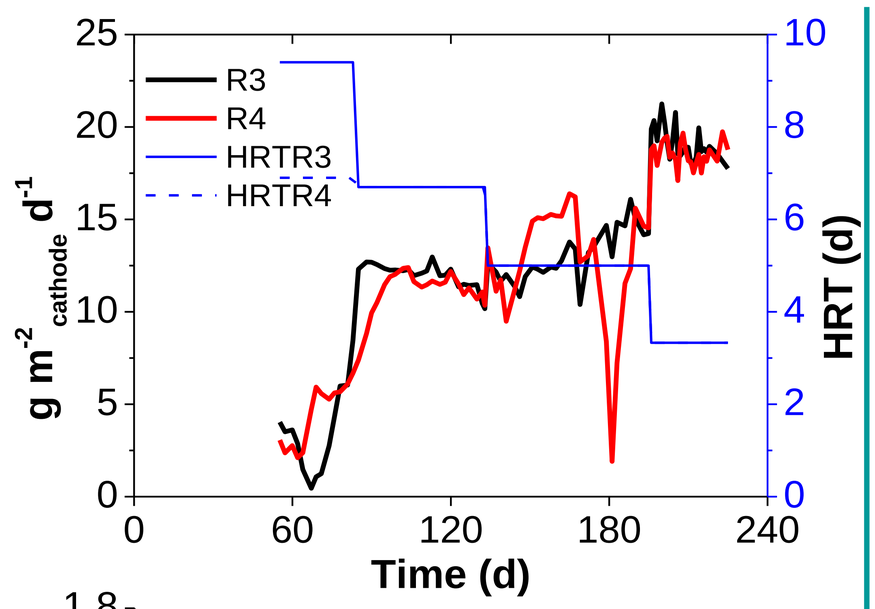
Batch production profiles



Continuous production profiles



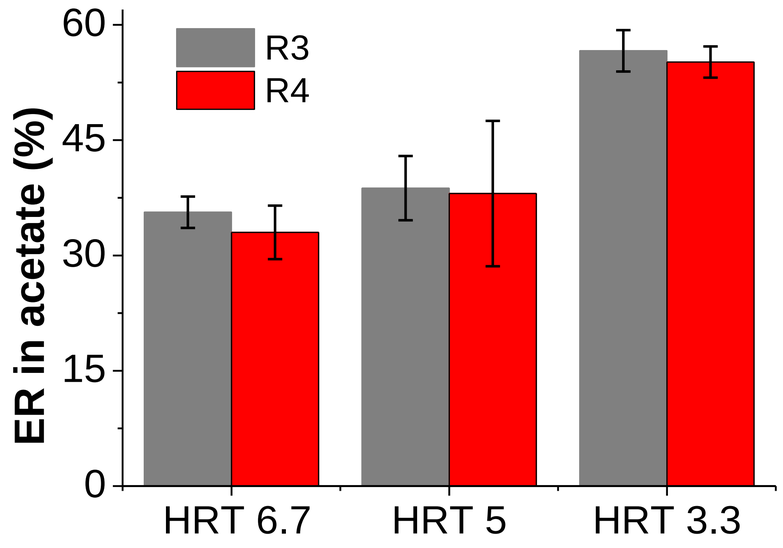
Continuous acetate production rates



HRT: Hydraulic retention time

↑ in the production rates with ↓ in HRT

Electron recovery (ER)



VFAs: Volatile fatty acids

HRT influences electron recovery in acetate and H_2

KEY OBSERVATIONS

- Improved acetate titers (up to. 6.4 g L^{-1}) by improving cathode to cathoyte ratio and mixing in reactors
- Long term, continuous and stable acetate production at higher rates (than batch reactors) for >6 months
- Higher volumetric acetate production rates up to 1 g $L^{-1}_{catholyte}$ d^{-1} at HRT 3 d
- Robust performance by the microbial community

ACKNOWLEDGEMENTS

SEVENTH FRAMEWORK PROGRAMME
MARIE CURIE ACTIONS
erc
ELECTROTALK