

Project Highlights



Biotechnology and Sustainable Chemistry

Principal investigators and competences



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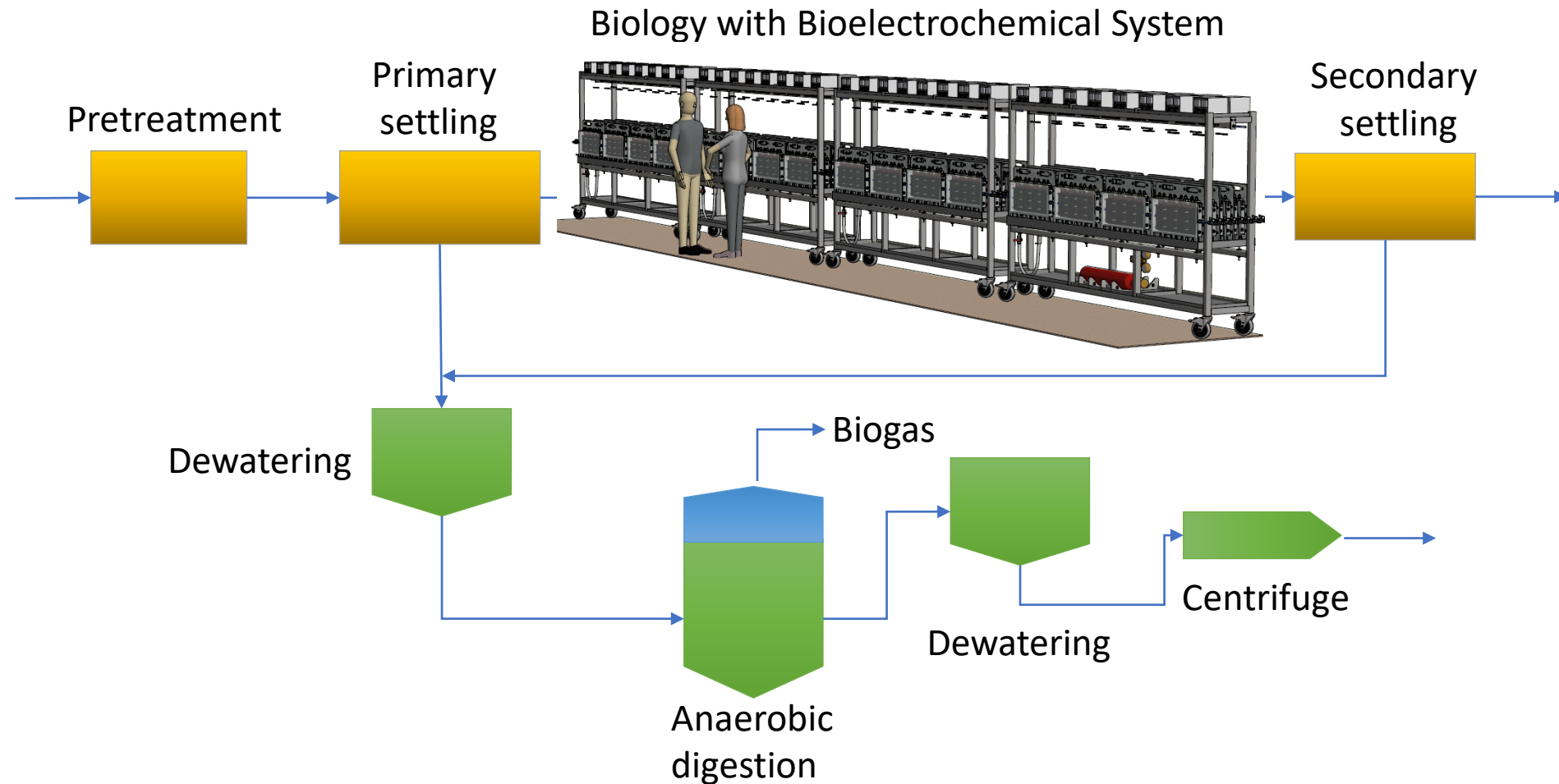
Dr. Manfred Zinn

Energy systems and sustainable resources

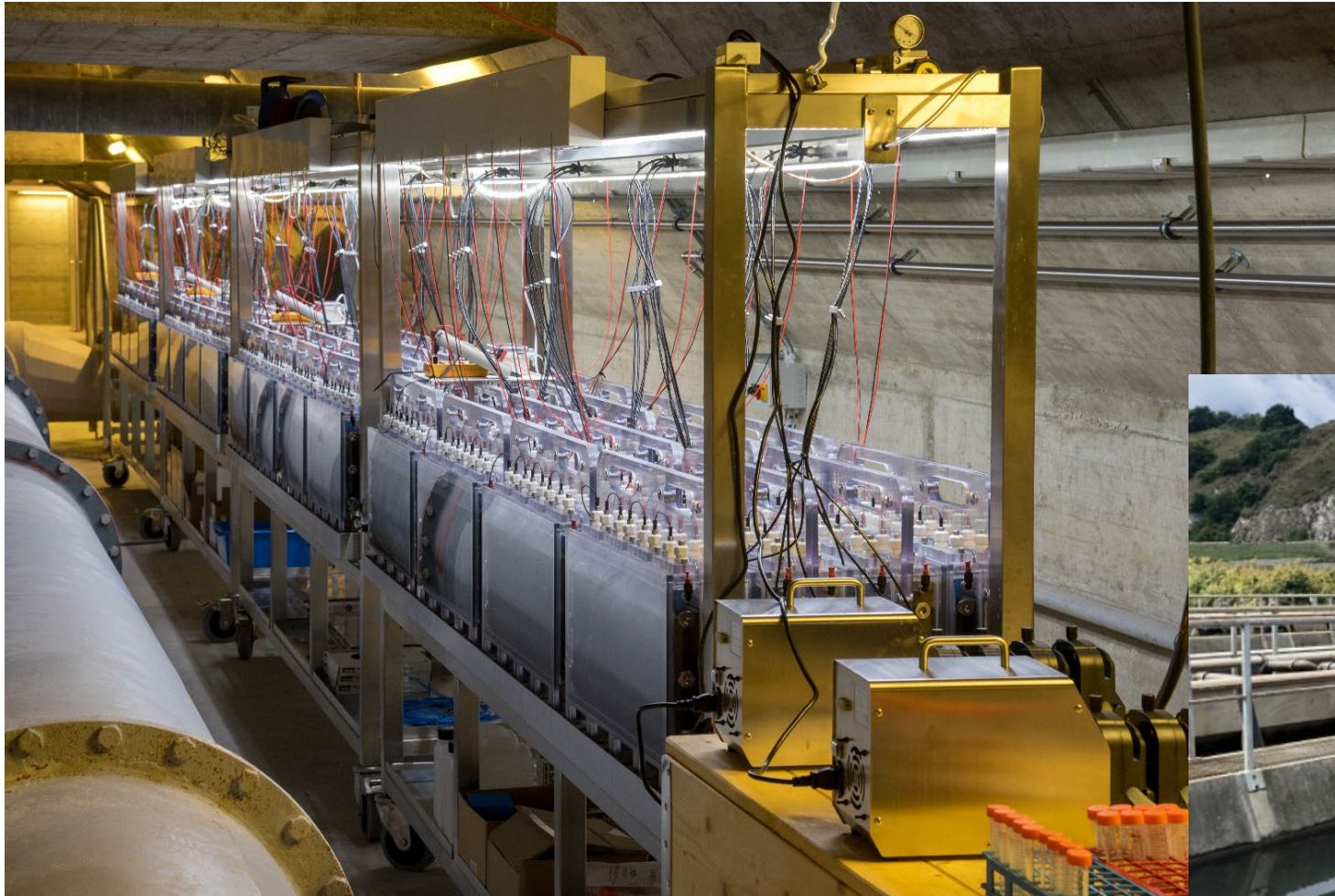
Advanced Bioprocess Engineering

Data acquisition, analysis and modeling

Implementation of a large microbial fuel cell in a wastewater treatment plant



Fully equipped 1000 liter MFC-Stack



Wastewater treatment plant in
Châteauneuf (Sion)

MFC is fed with wastewater from a
decanter.



<https://www.hydro.ch/en/chateauneuf-wwtp-regulations-command-control/45.html>

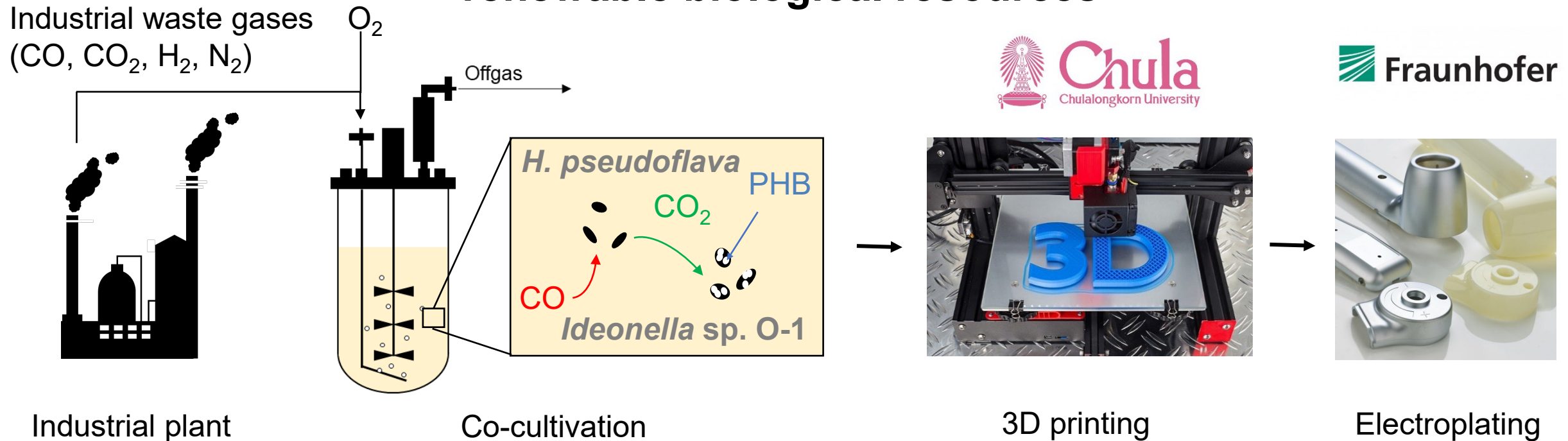
Comparison and conclusions

Entry N°	MFC [L]	Wastewater	Energy Density [kWh/m ³] [kWh/kgCOD]	COD Removal [%]	Coulombic Efficiency [%]	Energy Efficiency [%]	University / Institute Country (Year)
1	20	Municipal	0.004 0.011	80	0.30	0.28	Connecticut Univ USA (2011)
2	10	Brewery	0.200 0.109	87.1	7.6	2.8	Guangdong Inst China (2012)
3	250	Municipal	0.054 0.206	79	7	5.3	Harbin Inst China (2014)
4	90	Brewery	0.097 0.033	86.5	19.1	0.85	Harbin Inst China (2015)
5	45	Municipal	0.025 0.360	67.0	24.8	9.3	Ruhr Univ Germany (2016)
6	72	Synthetic	0.131 0.473	97	14	12.3	Tsinghua Univ China (2016)
7	20	Brewery	0.310 0.359	94.5	53.6	9.3	J. Craig Venter Inst USA (2017)
8	1000	Municipal	0.015 0.242	80	75	6.3	Tsinghua Univ China (2018)
9	1030	Municipal	0.060 0.469	95.4	14.9	12.1	HESSO Valais Univ Switzerland (2019)



BIOPLATE

Electroplating processes for biodegradable materials obtained from renewable biological resources



Industrial plant

Co-cultivation

3D printing

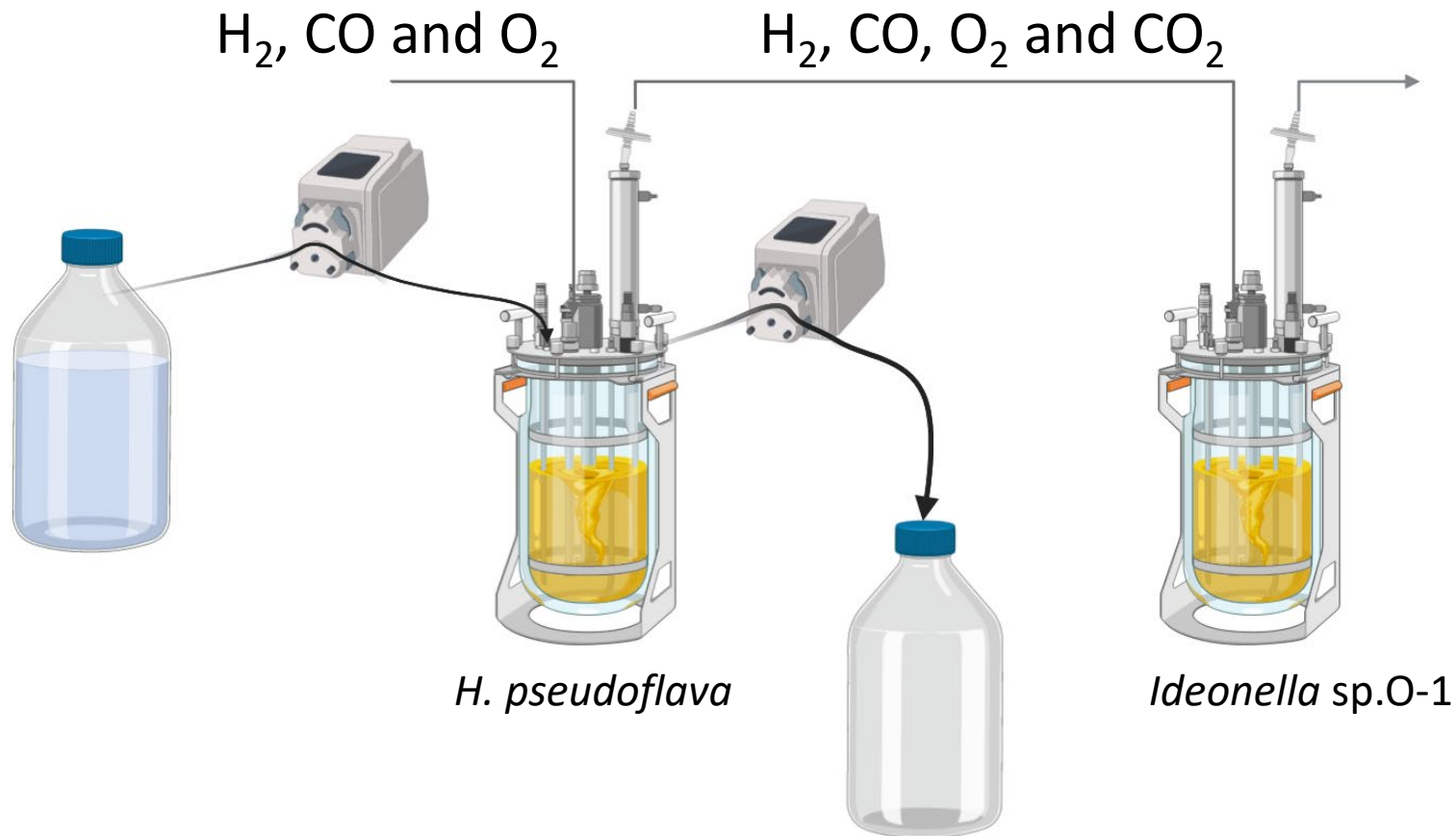
Electroplating

CH: Nils Hanik, Florian Miserez, Sven Panke, Manfred Zinn

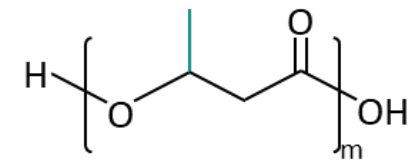
TH: Chuanchom Aumnate, Yuttanant Boonyongmaneerat

DE: Martin Metzner, Katja Feige

2-stage cultivation

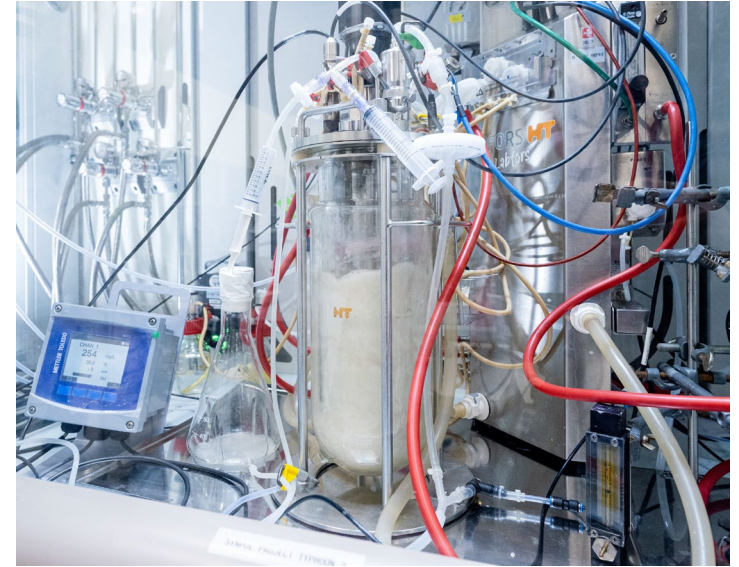


Florian Miserez



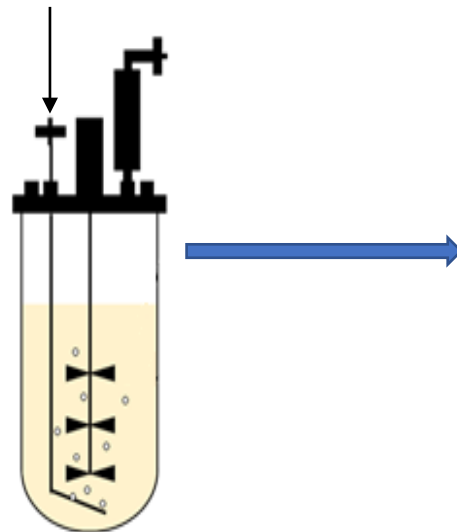
1. CO₂ production optimization

Optimization of the **medium composition** during bioreactor cultivation



Optimized medium

20 % CO, 40 % H₂, 0 % CO₂, 4 % O₂



Stage 1 bioreactor

CDW_{max} increased by 370 %

(3.9 → 12 g/L)

Volumetric specific CO₂ production increased by 87 %

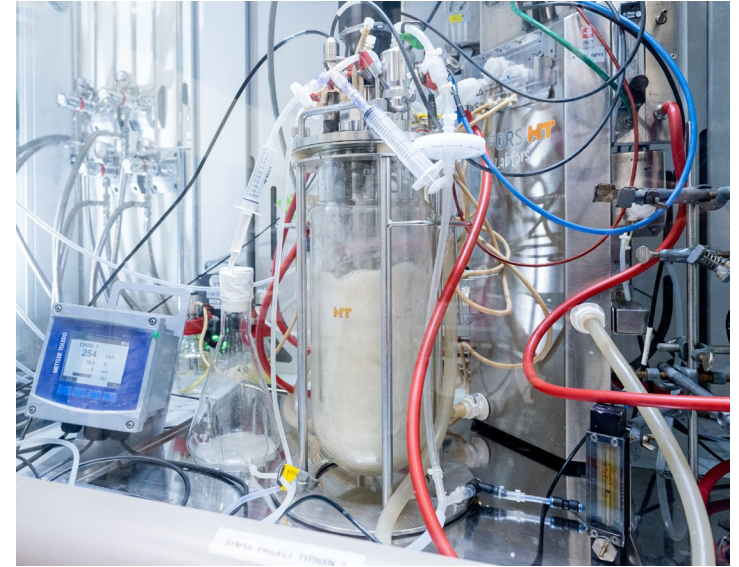
(4 → 7.5 mL·L⁻¹·min⁻¹)

2. PHB production optimization

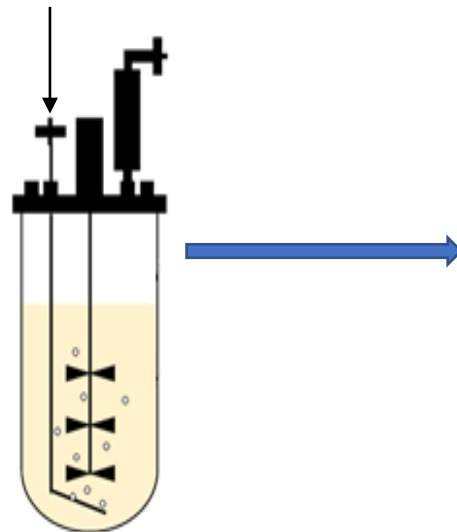
Confirmation during bioreactor cultivation

Optimized gas composition

40 % H₂, 20 % CO, 7.5 % CO₂, 4 % O₂



Stage 2 bioreactor



μ increased by 250 %

(0.085 \rightarrow 0.3 h⁻¹)

PHB acc. increased by 200 %

(15 \rightarrow 45 %)

PHB conc. increased by 300 %

(0.35 \rightarrow 1.5 g/L)

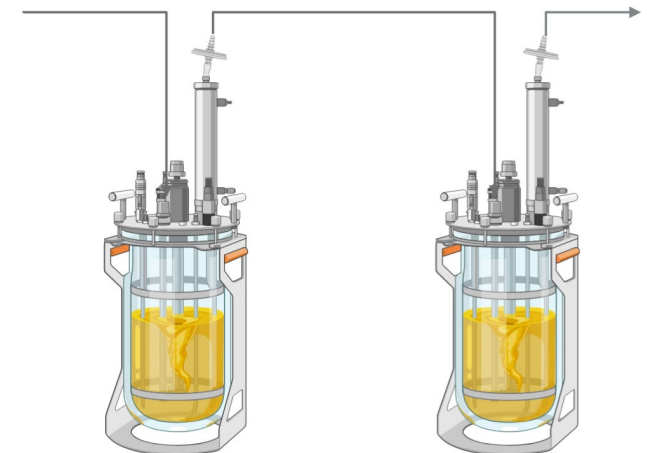
2-stage cultivation (combined)

H. pseudoflava:

- Constant CO₂ production (around 2.5 % of the gas output)
- Stable for 2 months

Ideonella:

- Small decrease of μ (<10 %)
- PHB accumulation of 45 %



H. pseudoflava *Ideonella* sp.O-1



Many thanks for your attention!

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