

## Electroautotrophic production of butanediols from CO<sub>2</sub> using engineered *Cupriavidus necator* H16

### AIMS:

1. Design and build a modular bioelectrochemical system (BES) optimized for electroautotrophic fermentations.
2. Manufacture novel electrode materials (Industrial partner) and optimize BES working parameters
3. Test the microbial reduction of CO<sub>2</sub> to 2,3 butanediol using *Cupriavidus necator* H16 as biocatalyst in BES.

### OUTCOMES:

A flexible and modular BES system has been designed (Figure 1) and built (Figure 2).

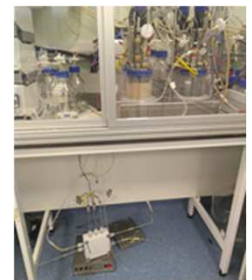
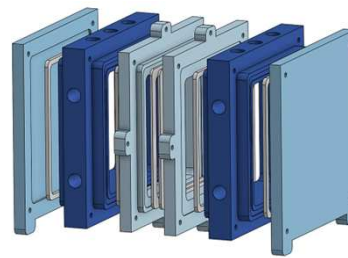


Figure 1: BES design

Figure 2: Gas-enabled BES

Electrodes manufactured by the industrial partner were tested in the BES for in-situ H<sub>2</sub> generation and 2,3 butanediol production shown in BES from CO<sub>2</sub> and H<sub>2</sub>.

### OUTPUT: 2,3-BDO production

and

### *in situ* H<sub>2</sub> generation

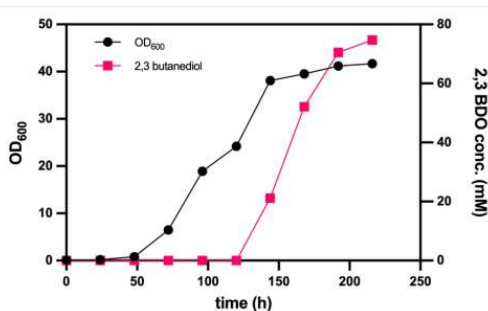


Figure 3. Quantification of 2,3 butanediol (2,3 BDO) production with *C. necator* H16 BD2 run at autotrophic conditions.

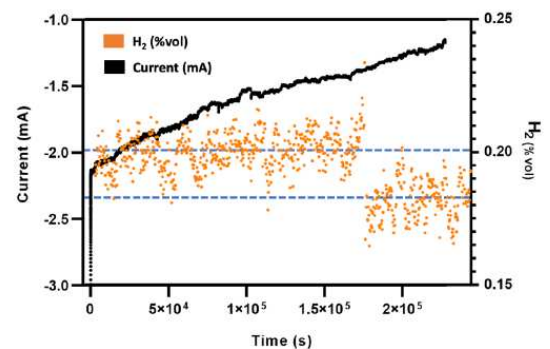


Figure 4. Hydrodynamic Linear Sweep Voltammetry (LSV) of the HER at -0.8V vs. an Ag wire correlated to the %volume of H<sub>2</sub> detected in the reactor off-gas by real-time Raman spectroscopy.