

RESEARCH PORTFOLIO

Microbial Electrosynthesis and Fermentation

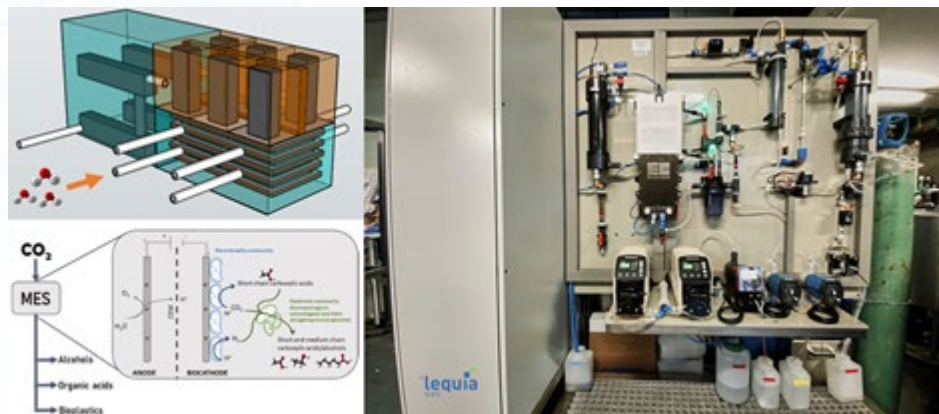
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Name of scientists in charge

- > **Dr Sebastià Puig**, Associate Professor "Serra Húnter". sebastia.puig@udg.edu
- > **Dr Maria Dolors Balaguer**, Full Professor. dolors.balaguer@udg.edu
- > **Dr Meritxell Romans**, Post-doctoral researcher. meritxell.romans@udg.edu

Technology description

- > Microbial electrosynthesis: from CO₂ to valuable products (i.e ethanol)
- > Biogas upgrading (electromethanogenesis)
- > Fermentation for middle chain carboxylic acid and alcohols production



Research expertise

- > Studies about CO₂ removal/transformation (biogas purification, bioelectrosynthesis of alcohols and volatile fatty acids)
- > Knowledge about BES design and scalability
- > Experience in fermentation biotechnology for middle-chain carboxylic acid production (caproate)
- > Knowledge of electrochemical characterization techniques
- > Identification of microbial population through molecular techniques
- > Digitalization of microbial electrosynthesis
- > Design and development of modules to capture CO₂ from indoor air in order to produce a concentrated stream to feed bioprocesses such as bioelectrochemical technologies to produce commodity chemicals

Projects

TRAMPOLINE - A training programme to promote the industrial adoption of microbial electrochemical technologies. European Commission. Call: HORIZON-MSCA-2023-DN-01. GA: 101167647. 2025-2028.

FUELS-C - An integrated platform of novel cost and energy-efficient conversion technologies producing liquid and gaseous biofuels from sustainable biogenic residues validated for direct use in fuel cells. European Commission. Call: HORIZON-CL5-2023-D3-02-07. GA: 101147442. 2024-2027.

ALGAESOL - Sustainable aviation and shipping fuels from microalgae and direct solar BES technologies. European Commission. Call: Horizon Europe – HORIZON-CL5-2023-D3-02-08. GA. 101147112. 2024-2027.

PANGEA - Process intensification for bioelectroCO₂ recycling into carbon-neutral products. Spanish Ministry of Innovation and Science. Call: Proyectos de Generación del Conocimiento 2021. Ref. PID2021-126240OB-I00. 2022-2025.

De-Cent - Portable bioelectrochemical modules for decentralised mitigation of CO₂ emissions using surplus energy. Spanish Ministry of Innovation and Science. Call: TED2021. Ref. PLEC2021-007802. 2022-2025.

Publications

Albarracín-Arias, J.A., Romans-Casas, M., Dessì, P., Balaguer, M.D. and Puig, S. **Digitalization of microbial electrosynthesis: Understanding operational variables for ethanol production optimization.** *Chemical Engineering Journal* (2026), 534, 174960.

Romans-Casas, M., Dessì, P., Balaguer, M. D., Puig, S., **Enhancing ethanol selectivity in microbial electrosynthesis from CO₂ via digital process control,** *Journal of CO₂ Utilization* (2026), 106, 2026, 103391.

Bolognesi, S., López, L. R., Perona-Vico, E., Bañeras, L., Balaguer, M. D., Puig, S., **Breathe inside the box: optimizing conditions for bioelectrochemical methane production to indoor carbon dioxide valorization and enhance air quality,** *Chemical Engineering Journal* (2025), 522, 2025, 167426.

Dessì, P., Romans-Casas, M., Perona-Vico, E., Tedesco, M., Hamelers, H.V.M., Bañeras, L., Balaguer, M.D. and S. Puig. **Membrane-based fermentation enables highly selective caproic acid production from wine lees.** *Chemical Engineering Journal* (2024), 497, 154539.

Romans-Casas, M., L. Feliu-Paradedada, M. Tedesco, H. V.M. Hamelers, L. Bañeras, M. D. Balaguer, Puig, S. and P. Dessì. 2024. **Selective butyric acid production from CO₂ and its upgrade to butanol in microbial electrosynthesis cells,** *Environmental Science and Ecotechnology* (2024), 17, 100303.

Feliu-Paradedera, L., Puig, S. and Bañeras, L. **Design and validation of a multiplex PCR method for the simultaneous quantification of Clostridium acetobutylicum, Clostridium carboxidivorans and Clostridium cellulovorans.** *Scientific Reports* (2023). 13(1), 20073.

Romans-Casas M., Perona-Vico E., Dessì P., Bañeras L., Balaguer M.D., Puig S. **Boosting ethanol production rates from carbon dioxide in MES cells under optimal solventogenic conditions,** *Science of the Total Environment* (2023), 85615, 159124.

Dessì, P., Buenaño-Vargas, C., Martínez-Sosa, S., Mills, S., Trego, A., Ijaz, U.Z., Pant, D., Puig, S., O'Flaherty, V., Farràs, P. **Microbial electrosynthesis of acetate from CO₂ in three-chamber cells with gas diffusion biocathode under moderate saline conditions,** *Environmental Science and Ecotechnology* (2023), 16, 100261.

Patents

Bioprocess for the production of elongated carboxylic acids – Inventors: Paolo Dessì, Sebastià Puig Broch, Meritxell Romans Casas, Maria Dolores Balaguer Condom. WO2024256436A1.