



<sup>®</sup> **lequia**  
UdG

ECO-INNOVATIVE  
ENVIRONMENTAL  
SOLUTIONS

REPORT 2019 - 2022

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**Dr Manel Poch and  
Dr Maria Dolors Balaguer**

LLEQUIA Group Leaders 2019-2022

# FOUR LONG YEARS OF UPHEAVAL AND HOPE\_\_\_\_\_

**This report covers one of the most exciting and turbulent periods of the history of our research group. It starts in 2019, when we assumed our posts. Three new European projects had just started, one of our senior researchers had been promoted to Associate Professor, and we were ready to host the main European conference on microbial technologies (EU-ISMET) in 2020. Definitely, Dr Jesús Colprim, the former director, had done a good job.**

In such a scenario, one of our first objectives as group leaders was to celebrate LEQUIA's twenty-fifth anniversary. More than 50 former LEQUIA PhD students and collaborators sent contributions for a commemorative book, and we organised a workshop focused on water challenges that attracted 130 people. This, together with relevant scientific achievements, made LEQUIA's future look bright.

However, the Covid-19 outbreak soon introduced an unexpected change of script. We had to delay or modify some experimental work during lockdown, we postponed the 5th edition of EU-ISMET conference until 2021 and held it online, and professors had to learn how to give lectures through a screen or with a mask. These major changes in socialisation had their counterpart in the definition of research topics. Experiencing a pandemic made us realise how important it was to increase the resilience of urban water cycle, and we devoted one whole project to address this challenge. It also brought to light how much the quality of indoor air affects our health, and we expanded our work on CO<sub>2</sub> capture and bioconversion to enclosed environments.

In a broader way, Covid-19 pandemics and the alarming data on climate change presented in the COP-26 conference in 2021 reaffirmed the need to tackle technological challenges through a more open,

global, holistic and multi-disciplinary approach. The water-energy-food and the water-health nexus are now more relevant than ever. Concepts like water digitalisation, nature-based solutions, de-centralisation or hydro-social cycle have emerged as key drivers for ecological transition, and are fully integrated in our portfolio. As for the need of international cooperation, we have increased collaborations across and outside the European Union and become the coordinators of one Erasmus+ project with research institutions from Southeast Asia.

These four long years of upheaval have indeed tested LEQUIA's resilience and even antifragility, but have also produced outstanding outcomes. In 2021, we broke the record of the annual number of publications. In 2022, for the first time we had more than 2M€ of turnover and five of our researchers founded Ecomemb, a spinoff company devoted to recycle reverse osmosis membranes for water treatment. Our DNA, which has always combined research and technology transfer, remains. As does our willingness to contribute to scientific and technological development to address major environmental and social challenges.



## WHO WE ARE

**The Laboratory of Chemical and Environmental Engineering (LEQUIA) is a research group of the University of Girona (UdG) devoted to the development of eco-innovative environmental solutions.**

LEQUIA is part of UdG's Institute of the Environment (IMA) and participates actively in "Campus UdG Aigua".

LEQUIA is recognised by the Catalan Agency for Management of University and Research Grants (AGAUR) as a "consolidated research group" (2021 SGR 01352) and has been granted with TECNIO quality seal, which distinguishes the leading experts in applied research and technology transfer in Catalonia.

### The team

LEQUIA has a team of 40 people, including university professors, post-doctoral and pre-doctoral researchers, and technical and management support staff. Because our work is multidisciplinary, LEQUIA projects often involve environmental scientists, chemists, biologists, biotechnologists, industrial engineers, agrarian engineers, and political scientists, among others.

### Research lines

- > Innovative bioprocesses for treatment, resource recovery and synthesis of new products.
- > Physicochemical advanced processes for treatment and/or reuse of liquid and gas side streams.
- > Planning, control and evaluation of complex environmental systems.

### Projects

Research activity is carried out with funds from national and international R&D projects, and technology transfer contracts with public and private organisations. Between 2019 and 2022, LEQUIA had an average annual turnover of 1.57 million euros (of which, 18% came from private funds).

### Post-graduate education

LEQUIA has always played an active role in postgraduate and doctorate programs of the University of Girona, such as the Master in Water Resources Science and Technology and the Doctorate Programme in Water Science and Technology. Currently, the group coordinates Erasmus+ project INOWASIA focused on the development of innovative multilevel formation programs for the new water leading professionals in Southeast Asia.

### Quality Certification

LEQUIA has a quality assurance management system certified by the Catalan Agency for Enterprise Competitiveness (ACCIÓ) and based on ISO 9000 standards and the EFQM excellence model.



Laboratory of chemical analysis



## FACILITIES

The group is based in the Faculty of Sciences of the UdG Montilivi Campus and a 550m<sup>2</sup> area in the Jaime Casademont building of the UdG's Science and Technology Park.

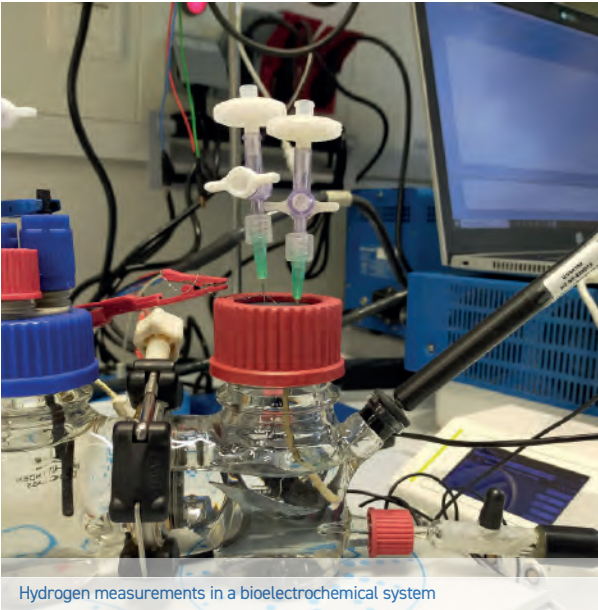
Available facilities include:

- > Fully instrumented pilot plants for water treatment and CO<sub>2</sub> conversion with different configurations for water treatment at laboratory and semi-industrial scale.
- > Specific equipment for water and gas characterization.
- > Analytical chemistry laboratory with generic and specific equipment for water characterisation.
- > Photoreactors for advanced oxidation processes.
- > Software for environmental modelling and life cycle assessment studies (LCA).
- > Access to the UdG's technical services, including analytical techniques such as ICP-MS, RMN, elemental analysis, XRD, XRF, SEM and TEM microscopy, GC-Ms, HPLC, MS and TGA.



Pilot plant for drinking water treatment





Hydrogen measurements in a bioelectrochemical system



INNOQUA pilot plant Quart



Laboratory set ups



Pilot plant for microbial electrosynthesis



Pilot plants - Membrane technologies



Recycling of membranes for water treatment

# Permanent staff

2023



## Dr M. Dolores Condom Balaguer

Full university professor and LEQUIA Group Leader  
[dolores.balaguer@udg.edu](mailto:dolores.balaguer@udg.edu)  
 ORCID: 0000-0001-6231-2163

Advanced biological technologies for urban and industrial wastewater treatment, mainly for nutrients removal. Operation of bio-electrochemical systems (BES) to treat domestic and industrial wastewater and polluted groundwater. Microbial electrolysis cells (MEC) to produce added-value products from carbon dioxide emissions.



## Dr Manel Poch Espallargas

Full university professor  
[manuel.poch@udg.edu](mailto:manuel.poch@udg.edu)  
 ORCID: 0000-0002-2593-9298

Development and application of decision support systems in the field of environmental technology. Sustainable management of conventional and advanced wastewater collection and treatment systems. River basin management. Selection and operation of natural systems for wastewater treatment. Urban water cycle integrated control (sewer system, sewage treatment plant). Eco-natural (water) systems.



## Dr Joaquim Comas Matas

Full university professor  
[joaquim.comas@udg.edu](mailto:joaquim.comas@udg.edu)  
 ORCID: 0000-0002-5692-0282

Multi-criteria decision support systems tools for environmental systems. Advanced modelling, control and sustainable assessment of urban water systems. Membrane bioreactors, integrated membrane systems and forward osmosis for wastewater and water reuse. Membrane recycling. Removal of micro-pollutants from water. Nature-based solutions to foster circular economy in cities.



## Dr Jesús Colprim Galceran

Full university professor  
[jesus.colprim@udg.edu](mailto:jesus.colprim@udg.edu)  
 ORCID: 0000-0002-6000-069X

Resource recovery from wastewaters. Struvite recovery from digested sludges. Partial nitrification/anammox processes. Aerobic granular sludge. Sludge reduction by decoupling oxidation-reduction metabolism. Bio-electrochemical systems for wastewater treatment, nitrate removal, CO<sub>2</sub> capture, and transformation to valuable products.



## Dr Maria Martín Sánchez

Tenured university professor  
[maria.martin@udg.edu](mailto:maria.martin@udg.edu)  
 ORCID: 0000-0003-2917-5691

Use of sewage sludge as adsorbent/catalyser for odour-causing compounds removal. Development of new adsorption and regeneration techniques through advanced oxidation processes for liquid and gaseous effluents. Removal of siloxanes and trace compounds in biogas.



## Dr Sebastià Puig Broch

Associate Professor "Serra Hünter Fellow"  
[sebastia.puig@udg.edu](mailto:sebastia.puig@udg.edu)  
 ORCID: 0000-0003-2995-1443

Water-Air-Energy-Food nexus. BioelectroCO<sub>2</sub> recycling. Biofuels. Electro bioremediation. Environmental biotechnology. Microbial electrosynthesis. Water recovery.



## Dr Ignasi Rodríguez-Roda Layret

Full university professor  
[Ignasi.rodriguezroda@udg.edu](mailto:Ignasi.rodriguezroda@udg.edu)  
 ORCID: 0000-0002-8989-9061

Membrane bioreactors and forward osmosis. Municipal wastewater and greywater treatment technologies. Micropollutants removal. Water reuse. Nature-based solutions. Sewer mining. Environmental Decision Support Systems.



## Dr Marta Verdaguer Planas

Tenured university professor  
[marta.verdaguer@udg.edu](mailto:marta.verdaguer@udg.edu)  
 ORCID: 0000-0001-8673-9866

Decision Support Systems applied to environmental domains. Integrated management of urban water cycle (sewer systems, wastewater treatment plant and receiving waters). Adaptation and application of combinatorial optimisation metaheuristic (ant colony optimisation) to environmental problems.

# Senior/Post-doctoral researchers

2023



## Dr Gaëtan Blandin

"La Caixa Junior Retaining Leader" fellow

gaetan.blandin@udg.edu  
ORCID: 0000-0002-0144-1014

**Research topics:** Membrane processes for desalination and water reuse. Forward osmosis for water purification or as concentration process (fundamentals of mass transfer, module design). Membrane fabrication and characterization. Membrane bioreactors (aerobic, anaerobic, microalgae...) bioprocesses at lab and pilot scale. Resource recovery. Small scale and pilot scale testing of membrane processes for separation/concentration.

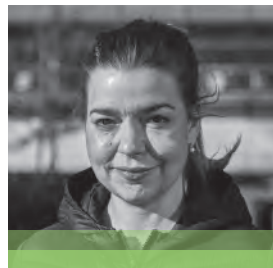


## Dr Silvia Bolognesi

"Juan de la Cierva Formación" fellow

s.bolognesi@udg.edu  
ORCID: 0000-0002-9947-0488

**Research topics:** Microbial electrochemical technologies for biofuels and bioenergy production.

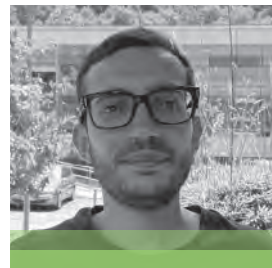


## Dr Alba Cabrera Codony

"Juan de la Cierva Incorporación" fellow

alba.cabrera@udg.edu  
ORCID: 0000-0002-4057-8697

**Research topics:** Adsorption technologies, development, and integration of nanoporous materials for treatment of gaseous effluents, air purification and water environments. CO<sub>2</sub> direct air capture. Biotechnologies for biogas upgrading and purification. Advanced Oxidation Processes to minimize the formation of disinfection by-products in Drinking Water. Development of mathematical models for environmental applications of column adsorption.



## Dr Paolo Dessì

"Marie Skłodowska Curie" fellow

Paolo.dessi@udg.edu  
ORCID : 0000-0002-9935-3038

**Research topics:** CO<sub>2</sub> capture and conversion to platform chemicals by microbial electrosynthesis and fermentation; focus on bioreactor and bioprocess design and optimization, and product extraction and concentration.



## Dr Raquel García Pacheco

"Juan de la Cierva Incorporación" fellow

raquel.garcia@udg.edu  
ORCID: 0000-0002-6993-0746

**Research topics:** End-of-life reverse osmosis membrane recycling. Integration of recycled membranes in water processes. Decision making tools.



## Dr Luis Rafael López de León

"Marie Skłodowska Curie" fellow

Luisrafael.lopez@udg.edu  
ORCID : 0000-0003-0795-2357

**Research topics:** Capture and bioconversion of CO<sub>2</sub> to improve indoor air quality. Miniaturization of biological reactors for process intensification. Design and optimization of bioreactors for biogas upgrading. Mathematical modeling of gas phase bioreactors for process optimization. Design and application of control strategies in biological reactors.



## Dr Albert Magrí Aloy

Senior researcher

albert.magri@udg.edu  
ORCID: 0000-0002-5203-3723

**Research topics:** Nutrient recovery and removal from wastewaters, anaerobic digestates, and other liquid waste streams. Livestock manure management and treatment. Anammox-based processes. Phosphate salts precipitation.



## Dr Hèctor Monclús Sales

"Ramón y Cajal" fellow

hector.monclus@udg.edu  
ORCID: 0000-0002-0072-6069

**Research topics:** Development of environmental decision support systems (EDSS) for drinking water treatment and wastewater treatment. Critical tests to evaluate new membrane modules (submerged and side-stream). Development of reliable and sensitive indicators for membrane filtration and for real-time control of drinking water Systems (treatment and distribution).



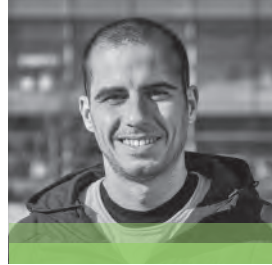


**Dr Lucia Alexandra Popartan**

"Juan de la Cierva Formación" fellow

[Luciaalexandra.popartan@udg.edu](mailto:Luciaalexandra.popartan@udg.edu)  
ORCID: 0000-0002-2308-4062

**Research topics:** Integral management of urban water cycle within the circular economy paradigm. Study of socio-natural (water) Systems.



**Dr Narcís Pous Rodríguez**

Senior researcher  
[narcis.pous@udg.edu](mailto:narcis.pous@udg.edu)  
ORCID: 0000-0003-2034-1251

**Research topics:** Groundwater and wastewater electro-bioremediation. Ammonium valorisation. Nature-based solutions using zooplankton. Electricity-driven single-cell protein production.



**Dr Laura Rovira Alsina**

Postdoctoral researcher  
[l.rovira@udg.edu](mailto:l.rovira@udg.edu)  
ORCID: 0000-0003-2339-843X

**Research topics:** Microbial electro-technologies for the conversion of carbon dioxide into value added products. Electricity-driven single-cell protein production.

# Predocctoral researchers

2023



## Nicole Arnaud de Aguiar

nicole.arnaud@udg.edu  
ORCID: 0000-0002-5877-2199

**Doctoral thesis:** Development of a decision support system for the resilient management of urban wastewaters within the context of water emergencies. FI grant

**Supervisors:** Dr Manel Poch



## Oriol Carbó Monmany

oriol.carbo@udg.edu  
ORCID: 0000-0001-5701-3775

**Doctoral thesis:** Aerobic granular sludge (AGS) and low load anammox processes for energy sustainable wastewater treatment plants. Industrial doctorate with GS INIMA Environment.

**Supervisors:** Dr Jesús Colprim and Dr Albert Magrí



## Alba Ceballos-Escalera

alba.ceballoescalera@udg.edu  
ORCID: 0000-0001-7940-7329

**Doctoral thesis:** Water bioremediation by means of bioelectrochemical systems. FI grant.

**Supervisors:** Dr Sebastià Puig, Dr Maria Dolors Balaguer and Dr Narcís Pous



## Emma Company Masó

emma.company@udg.edu  
ORCID: 0000-0001-7528-9679

**Doctoral thesis:** Nutrients recovery from swine manure. IF grant.

**Supervisors:** Dr Albert Magrí and Dr Jesús Colprim



## Laura Ferràndez Galceran

laura.ferrandez@udg.edu  
ORCID: 0000-0001-5383-5851

**Doctoral thesis:** Optimisation of Figueres drinking water treatment plant by means of Artificial Intelligence techniques. Industrial doctorate with FISERSA.

**Supervisors:** Dr Hèctor Monclús



## Albert Galizia Amoraga

albert.galizia@udg.edu  
ORCID: 0000-002-8203-732-X

**Doctoral thesis:** Control and automation of membrane systems. FI grant.

**Supervisors:** Dr Hèctor Monclús, Dr Joaquim Comas and Dr Gaëtan Blandin



## Ana Noemí Gómez Vaca

ananoemi.gomez@udg.edu  
ORCID: 0000-0003-1118-5007

**Doctoral thesis:** Urban water cycle management. IF grant.

**Supervisors:** Drs Ignasi Rodríguez-Roda and Manel Poch



## Pere Olives Cegarra

pere.olives@udg.edu  
ORCID: 0009-0009-9412-5771

**Doctoral thesis:** Concentration of volatile fatty acids by membranes to obtain PHAs. Industrial doctorate with VEnvirontech Biotechnology S.L.

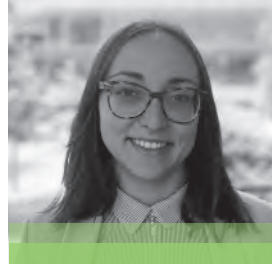
**Supervisors:** Dr Gaëtan Blandin and Dr Ignasi Rodríguez-Roda



**Yarima Recalde Aza**  
 yarima.recalde@udg.edu  
 ORCID: 0000-0002-4703-2275

**Doctoral thesis:** Urban water cycle management. FI grant.

**Supervisors:** Dr Ignasi Rodríguez-Roda



**Meritxell Romans Casas**  
 meritxell.romans@udg.edu  
 ORCID: 0000-0002-0609-0508

**Doctoral thesis:** Bio-electro CO<sub>2</sub> recycling into added value compounds. FPU grant.

**Supervisors:** Drs Sebastià Puig and Maria Dolors Balaguer



**Meritxell Valentí Quiroga**  
 meritxell.valenti@udg.edu  
 ORCID: 0000-0001-9705-9487

**Doctoral thesis:** Control on the formation of disinfection by-products in drinking waters: combination of advanced characterization and modeling techniques. FI-SDUR grant.

**Supervisors:** Dr Maria Martín and Dr María José Farré



**Carla Vázquez Gomara**  
 carla.vazquez@udg.edu  
 ORCID: 0000-002-0038-1507

**Doctoral thesis:** Hydrodynamic modelling tools for the optimisation of wastewater treatment plants. Industrial doctorate with ACCIONA Agua.

**Supervisors:** Dr Jesús Colprim



**Pol Vidal Lamolla**  
 pol.vidal@udg.edu  
 ORCID: 0000-0002-2664-2373

**Doctoral thesis:** Analysis and improvement of urban water cycle service users' satisfaction level. Industrial doctorate with Aigües de Barcelona.

**Supervisors:** Dr Manel Poch



**Rajashree Yalamanchili**  
 rajashree.yalamanchili@udg.edu  
 ORCID: 0000-0002-4540-1452

**Doctoral thesis:** Membrane technology to transform urban wastewater treatment in resource recovery factory. IF grant.

**Supervisors:** Dr Gaëtan Blandin



**Bianca Zappulla Sabio**  
 bianca.zappulla@ug.edu  
 ORCID: 0000-0001-7150-591X

**Doctoral thesis:** Recycling of membranes for water treatment. Osmo4Lives project.

**Supervisors:** Dr Raquel García and Dr Gaëtan Blandin

# Technical support staff

2023



**Dr Teresa Bosch Vilardell**  
teresa.bosch@udg.edu

Business development and quality manager



**Gemma Rustullet Prat**  
gemma@udg.edu

Laboratory technician



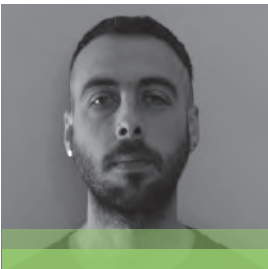
**David Abert Fernández**  
david.abert@udg.edu

Research technician on drinking water treatment



**Enric Cassú Camps**  
enric.cassu@udg.edu

Research technician on socio-natural systems

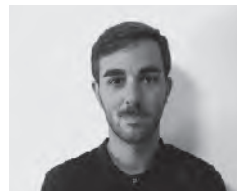


**Nicolás Saganias**  
nicolas.saganias@udg.edu

Research technician on control systems



# Doctoral theses



## Integrated assessment of wastewater treatment plants and their receiving river systems in a global change context

**Author:** Ignasi Aymerich **Supervisors:** Dr Lluís Corominas, Dr Vicenç Acuña and Dr Ignasi Rodríguez-Roda  
**Defense date:** 21/01/2019 **Awards and recognitions:** cum laude



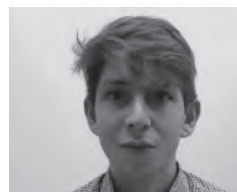
## Environmental and socio-economical assessment of measures for the reduction of pharmaceuticals in rivers

**Author:** Vicent Pau Gimeno Melià **Supervisors:** Dr Lluís Corominas and Dr Joaquim Comas  
**Defense date:** 22/01/2019. Industrial doctorate (MSCA) with company Atkins  
**Awards and recognitions:** cum laude, international mention



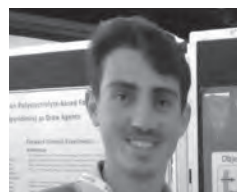
## Taking advantage of autotrophic nitrogen removal: Potassium and phosphorus recovery from municipal wastewater

**Author:** Sarah Johansson **Supervisors:** Dr. Jesús Colprim, Dr. Maël Ruscallada and Dr Bart Saerens (Aquafin)  
**Defense date:** 29/04/2019. Industrial doctorate (MSCA) with company Aquafin  
**Awards and recognitions:** cum laude, international mention



## Evaluation and Comparison of Advanced Treatment Technologies to Enhance the Removal of Pharmaceutical Active Compounds from WWTP Secondary Effluent

**Author:** Luca Sbardella **Supervisors:** Dr Ignasi Rodríguez-Roda, Dr, Joaquim Comas  
**Defense date:** 22/05/2019 **Awards and recognitions:** cum laude, international mention



## Mass Transport and Fouling of Novel TFC Forward Osmosis Membranes

**Author:** Marc Sauchelli **Supervisors:** Dr Ignasi Rodríguez-Roda and Dr. Wolfgang Gernjak (ICRA)  
**Defense date:** 18/07/2019 **Awards and recognitions:** cum laude



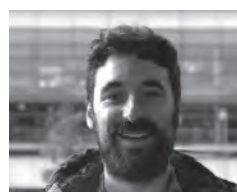
## Operational strategies towards nitrification-anammox implementation for mainstream municipal wastewater treatment

**Author:** Tiago Vitor Akaboci **Supervisors:** Dr Jesús Colprim, Dr Maël Ruscallada and Dr Maria Dolors Balaguer  
**Defense date:** 15/07/2019 **Awards and recognitions:** cum laude



## Abatement of siloxanes in sewage biogas: coupling adsorption and biological treatments

**Author:** Èric Santos Clotas **Supervisors:** Dr Maria Martín, Dr Joaquim Comas and Dr Alba Cabrera  
**Defense date:** 08/11/2019 **Awards and recognitions:** cum laude, international mention



## Steering CO<sub>2</sub> bio-electrorecycling into valuable compounds through inline monitoring of key operational parameters

**Author:** Ramiro Blasco Gómez **Supervisors:** Dr Jesús Colprim, Dr Sebastià Puig and Dr. Maria Dolors Balaguer  
**Defense date:** 22/06/2020 **Awards and recognitions:** cum laude, international mention, "Extraordinary PhD award of UdG Doctorate Programme in Water Science and Technology"



### The socio-cognitive dimension of water: the politisation of water in Barcelona

**Author:** Lucia Alexandra Popartan **Supervisors:** Dr Manuel Poch and Dr M. José Amores (Cetaqua)  
**Defense date:** 08/10/2020. Industrial doctorate with technological center CETAQUA  
**Awards and recognitions:** cum laude



### Combining forward osmosis and anaerobic membrane bioreactor technologies for raw municipal wastewater treatment

**Author:** Federico Ferrari **Supervisors:** Dr Ignasi Rodríguez-Roda, Dr Maite Pijuan (ICRA) and Dr Soraya Zahedi (ICRA)  
**Defense date:** 14/10/2020 **Awards and recognitions:** cum laude



### Design and implementation of an EDSS for the control and management of DWTPs

**Author:** Lluís Godo Pla **Supervisors:** Dr Hèctor Monclús and Dr Fernando Valero (ATL)  
**Defense date:** 05/11/2020. Grant cofounded by ATL and UdG  
**Awards and recognitions:** cum laude, "Best doctoral thesis on integrated urban water cycle by FACSA Chair - University Jaume I"



### Development of strategies for waste valorization in waste water treatment plants (WWTPS): Consorci Besòs Tordera case study

**Author:** David Palma Heredia **Supervisors:** Dr Manel Poch and Dr Miquel Àngel Cugueró  
**Defense date:** 08/02/2021. Industrial doctorate with Consorci Besòs Tordera  
**Awards and recognitions:** cum laude



### Microbial electrochemical technologies for biofuels and bioenergy production

**Author:** Silvia Bolognesi **Supervisors:** Dr Sebastià Puig and Dr Andrea Capodaglio (UniPV)  
**Defense date:** 22/03/2021. Joint doctorate between Universitat de Girona and Università degli studi di Pavia (Italy)  
**Awards and recognitions:** international mention



### Remediation of multi-contaminated groundwater using bioelectrochemical systems

**Author:** Giulia Puggioni **Supervisors:** Dr Alessandra Carucci (UNICA), Dr Sebastià Puig and Dr Stefano Milia (CNR)  
**Defense date:** 20/03/2022 **Awards and recognitions:** cum laude, international mention. Joint doctorate between Universitat de Girona and Università degli Studi di Cagliari (Italy)



### Importance of hydrogen-mediated mechanisms for microbial electrosynthesis: regulation at the molecular level

**Author:** Elisabet Perona Vico **Supervisors:** Dr Lluís Bañeras (gEMM-UdG) and Dr Sebastià Puig  
**Defense date:** 28/01/2022 **Awards and recognitions:** cum laude



### Development of an environmental decision support system to enhance coagulation in drinking water treatment plants

**Author:** Jordi Suquet Masó **Supervisors:** Dr Hèctor Monclús and Dr Lluís Godo (Createch360°)  
**Defense date:** 29/07/2022 **Awards and recognitions:** cum laude



### Roadmap for scaling up thermophilic CO<sub>2</sub> bio-reduction to acetate: shedding light on using surplus renewable energy and industrial off-gases

**Author:** Laura Rovira Alsina **Supervisors:** Dr Maria Dolors Balaguer and Dr Sebastià Puig  
**Defense date:** 2/12/2022 **Awards and recognitions:** cum laude

Bioelectrochemical systems set up



## SELECTED PUBLICATIONS

### Adsorption processes for biogas upgrading

- > Santos-Clotas E., Cabrera-Codony A., Martín M.J., **Coupling adsorption with biotechnologies for siloxane abatement from biogas**, 2020, *Renewable Energy*, Volume 153, Pages 314 – 323.
- > Santos-Clotas E., Cabrera-Codony A., Boada E., Gich F., Muñoz R., Martín M.J., **Efficient removal of siloxanes and volatile organic compounds from sewage biogas by an anoxic biotrickling filter supplemented with activated carbon**, 2019, *Bioresource Technology*, Open Access, Volume 294, Article number 122136.
- > Santos-Clotas, E., Cabrera-Codony, A., Ruiz, B., Fuente, E., Martín, M.J., **Sewage biogas efficient purification by means of lignocellulosic waste-based activated carbons**, 2019, *Bioresource Technology*, March 2019, 207-215.

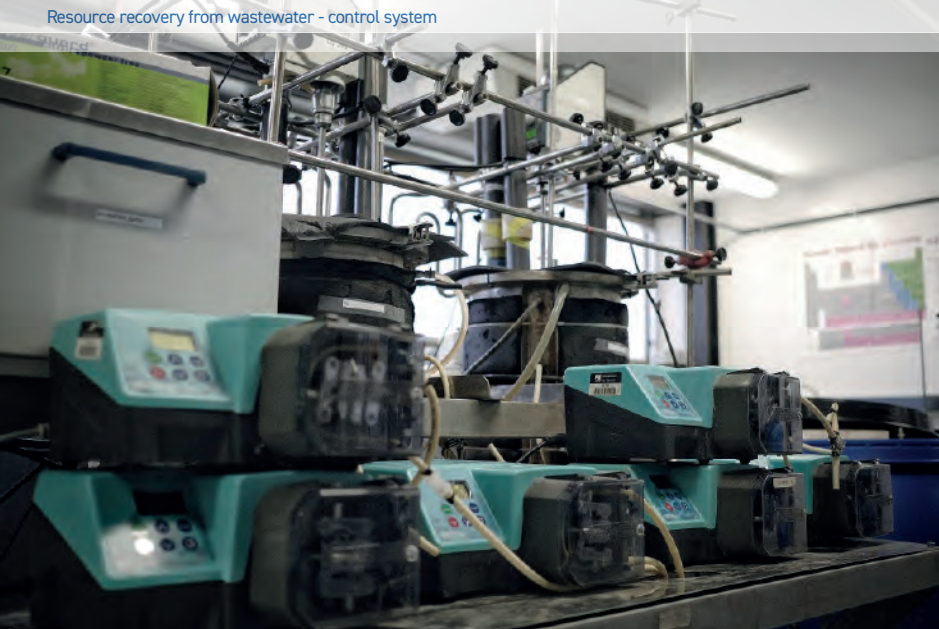


### Artificial intelligence in drinking water treatment

- > Vidal Lamolla P., Popartan A., Perello-Moragues, T., Noriega, P., Saurí, D., Poch, M., Molinos-Senante, M., **Agent-based modelling to simulate the socio-economic effects of implementing time-of-use tariffs for domestic water**, *Sustainable Cities and Society*, November 2022, Volume 86, Article number 104118.
- > Suquet J., Godo-Pla L., Valentí M., Ferràndez L., Verdaguer M., Poch M., Martín M.J., Monclús H., **Assessing the effect of catchment characteristics to enhanced coagulation in drinking water treatment: RSM models and sensitivity analysis**, 2021, *Science of the Total Environment*, Volume 79910, December 2021, Article number 149398.
- > Godo-Pla L., Emiliano P., Poch M., Valero F., Monclús H., **Benchmarking empirical models for THMs formation in drinking water systems: An application for decision support in Barcelona, Spain**, 2021, *Science of the Total Environment*, Volume 7631, Article number 144197.

- > Godo-Pla L., Rodríguez J.J., Suquet J., Emiliano P., Valero F., Poch M., Monclús H., **Control of primary disinfection in a drinking water treatment plant based on a fuzzy inference system**, 2021, *Process Safety and Environmental Protection*, Volume 145, Pages 63 – 70.
- > Suquet J., Godo-Pla L., Valentí M., Verdaguer M., Martín M.J., Poch M., Monclús H., **Development of an environmental decision support system for enhanced coagulation in drinking water production**, 2020, *Water (Switzerland)*, Open Access, Volume 12, Issue 8, Article number 2115.

Resource recovery from wastewater - control system



## Artificial intelligence in wastewater treatment\_\_\_\_

- > Oliva-Felipe L., Verdaguer M., Poch M., Vázquez-Salceda J., Cortés U., **The organisational structure of an agent-based model for the management of wastewater systems**, 2021, *Water (Switzerland)*, Volume 13, Issue 9, Article number 1258.
- > Palma-Heredia D., Verdaguer M., Molinos-Senante M., Poch M., Cugueró-Escofet M.À., **Optimised blending for anaerobic co-digestion using ant colony approach: Besòs river basin case study**, 2021, *Renewable Energy*, Volume 168, 141 – 150.
- > Blum C., Verdaguer M., Monclús H., Poch M., **A new optimization model for wastewater treatment planning with a temporal component**, *Process Safety and Environmental Protection*, April 2020, Volume 136, Pages 157 - 168.
- > Palma-Heredia D., Poch M., Cugueró-Escofet M.À., **Implementation of a decision support system for sewage sludge management**, 2020, *Sustainability (Switzerland)*, Volume 12, Issue 21, Pages 1 – 181, Article number 9089.



## Biological nutrient removal and recovery from wastewater

- > Company E., Farrés M., Colprim J., Magrí A., **Exploring the recovery of potassium-rich struvite after a nitrification-denitrification process in pig slurry treatment**, *Science of the Total Environment*, November 2022, Volume 84715, Article number 157574.
- > Magrí A., Company E., Gich F., Colprim J., **Hydroxyapatite Formation in a Single-Stage Anammox-Based Batch Treatment System: Reactor Performance, Phosphorus Recovery, and Microbial Community**, 2021, *ACS Sustainable Chemistry and Engineering*, Volume 9, Issue 7, Pages 2745 - 276, 122.
- > Magrí A., Rusalleda M., Vilà A., Akaboci T.R.V., Dolors Balaguer M. D., Llenas J.M., Colprim J., **Scaling-up and long-term operation of a full-scale two-stage partial nitritation-anammox system treating landfill leachate**, 2021, *Processes*, Volume 9, Issue 52021, Article number 800.
- > Akaboci T.R.V., Rusalleda M., Balaguer M.D., Colprim J., **Achieving nitrataion repression in an SBR at mainstream conditions through inorganic carbon limitation**, *International Biodeterioration and Biodegradation*, Volume 147, Article number 104865.
- > Magrí A., Carreras-Sempere M., Biel C., Colprim J., **Recovery of phosphorus from waste water profiting from biological nitrogen treatment: Upstream, concomitant or downstream precipitation alternatives**, *Agronomy*, Volume 10, Issue 7, July 2020, Article number 1039.
- > Johansson, S., Rusalleda, M., Saerens, B., Colprim, J., **Potassium recovery from centrate: taking advantage of autotrophic nitrogen removal for multi-nutrient recovery**, 2019, *Journal of Chemical Technology and Biotechnology*, Volume 94, Issue 3, March 2019, Pages 819-828.

## Characterisation and removal of emerging pollutants from water

- > Valenti-Quiroga M., Daunis-i-Estadella P., Emiliano P., Valero F., Martin, M. J., **NOM fractionation by HPSEC-DAD-OCD for predicting trihalomethane disinfection by-product formation potential in full-scale drinking water treatment plants**, 2022, *Water Research*, Volume 2271, December 2022 Article number 119314.
- > Sbardella L., Velo-Gala I., Comas J., Rodríguez-Roda Layret I., Fenu A., Gernjak W., **The impact of wastewater matrix on the degradation of pharmaceutically active compounds by oxidation processes including ultraviolet radiation and sulfate radicals**, 2021, *Journal of Hazardous Materials*, Volume 38015, Article number 120869.
- > Sbardella L., Gala I., Comas J., Carbonell S.M., Rodríguez-Roda I., Gernjak W., **Integrated assessment of sulfate-based AOPs for pharmaceutical active compound removal from wastewater**, 2020, *Journal of Cleaner Production*, Volume 2601 July 2020 Article number 121014.

Pilot plants- control system

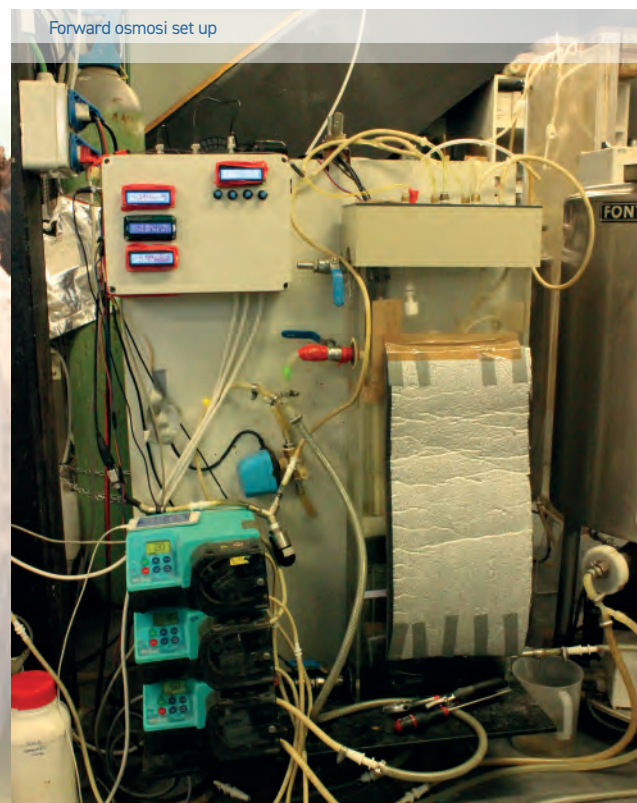
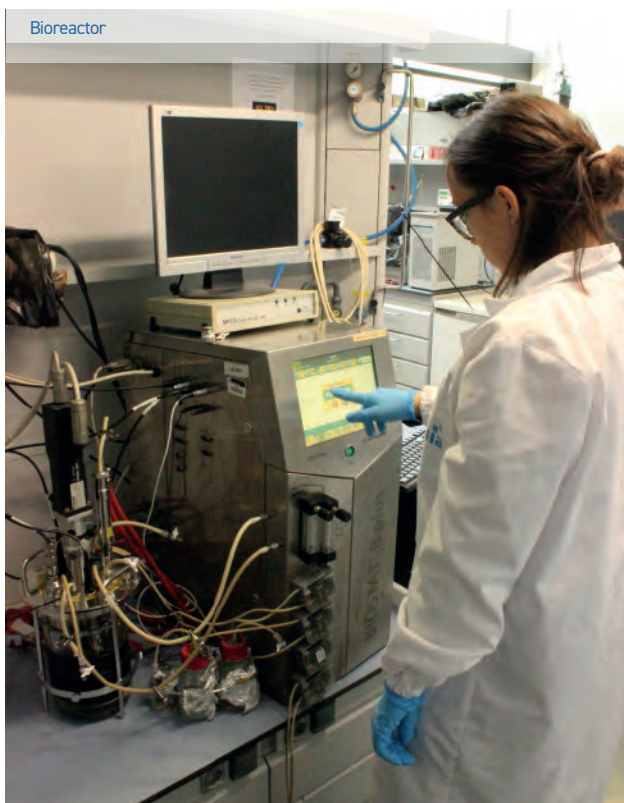


## Environmental, socio-economic and ethical-political assessment of water systems

- > Garrido-Baserba, M., Barnosell I., Molinos-Senante M., Sedlack D., Rabaey K., Schraa O., Verdaguer M., Rosso D., Poch M., The third route: A techno-economic evaluation of extreme water and wastewater decentralization, *Water Research*, June 2022, Volume 21830, Article number 118408.
- > Popartan L., Cortés A., Garrido-Baserba M., Verdaguer M., Poch M., Gibert K., **The Digital Revolution in the Urban Water Cycle and Its Ethical-Political Implications: A Critical Perspective**, , *Applied Sciences (Switzerland)*, March 2022, Volume 12, Issue 5, Article number 2511.
- > Senán-Salinas J., Blanco A., García-Pacheco R., Landaburu-Aguirre J., García-Calvo E., **Prospective Life Cycle Assessment and economic analysis of direct recycling of end-of-life reverse osmosis membranes based on Geographic Information Systems**, 2021, *Journal of Cleaner Production*, Volume 2821, Article number 124400.
- > Poch M., Garrido-Baserba M., Corominas L., Perelló-Moragues A., Monclús H., Cermerón-Romero M., Melitas N., Jiang S.C., Rosso D., **When the fourth water and digital revolution encountered COVID-19**, 2020, *Science of the Total Environment*, Volume 74420, Article number 140980.
- > Popartan L.A., Ungureanu C., Velicu I., Amores M.J., Poch M., **Splitting Urban Waters: The Politicisation of Water in Barcelona between Populism and Anti-Populism**, 2020, *Antipode*, Volume 52, Issue 5, Pages 1413 – 14331.
- > Morera S., Santana M.V.E., Comas J., Rigola M., Corominas L., **Evaluation of different practices to estimate construction inventories for life cycle assessment of small to medium wastewater treatment plants**, 2020, *Journal of Cleaner Production*, Volume 2451, Article number 118768.
- > Santana, M.V.E., Cornejo, P.K., Rodríguez-Roda, I., Buttiglieri, G., Corominas, L., **Holistic life cycle assessment of water reuse in a tourist-based community**, 2019, *Journal of Cleaner Production*, Volume 233, Pages 743-752.

## Membrane technologies for water treatment

- > Galizia A., Mamo J., Blandin G., Verdaguer M., Comas J., Rodríguez-Roda I., Monclús H., **Advanced control system for reverse osmosis optimization in water reuse systems**, 2021, *Desalination*, Volume 51815, Article number 115284.
- > Blandin G., Galizia A., Monclús H., Lesage G., Héran M., Martínez-Lladó X., **Submerged osmotic processes: Design and operation of hollow fiber forward osmosis modules**, *Desalination*, Volume 51815, Article number 115281.





Laboratory of bioelectrochemical systems

- > García-Pacheco R., Li Q., Comas J., Taylor R.A., Le-Clech P., **Novel housing designs for nanofiltration and ultrafiltration gravity-driven recycled membrane-based systems**, 2021, *Science of the Total Environment*, Volume 7671, Article number 144181.
- > Santos-Clotas E., Cabrera-Codony A., Comas J., Martín M.J., **Biogas purification through membrane bioreactors: Experimental study on siloxane separation and biodegradation**, 2020, *Separation and Purification Technology*, Volume 2381, Article number 116440.
- > Blandin, G., Rosselló, B., Monsalvo, V.M., Batlle-Vilanova, P., Viñas, J.M., Rogalla, F., Comas, J., **Volatile fatty acids concentration in real wastewater by forward osmosis**, 2019, *Journal of Membrane Science*, Pages 60-70.
- > García-Pacheco, R., Landaburu-Aguirre, J., Lejarazu-Larrañaga, A., Rodríguez-Sáez, L., Molina, S., Ransome, T., García-Calvo, E., **Free chlorine exposure dose (ppm-h) and its impact on RO membranes ageing and recycling potential**, *Desalination*, Pages 133-143.



## Microalgae coupled with other technologies

- > Bolognesi S., Bañeras L., Perona-Vico E., Capodaglio A., Balaguer M.D., Puig S., Puig S., **Carbon dioxide to bio-oil in a bioelectrochemical system-assisted microalgae biorefinery process**, Bolognesi S., Bañeras L., Perona-Vico E., Capodaglio A., Balaguer, M.D., Puig S., *Sustainable Energy and Fuels*, January 2022, Volume 6, Issue 1, 150 – 1617.
- > Bolognesi S., Bernardi G., Callegari A., Dondi D., Capodaglio A.G., **Biochar production from sewage sludge and microalgae mixtures: properties, sustainability and possible role in circular economy**, 2021, *Biomass Conversion and Biorefinery*, Volume 11, Issue 2, 289 – 299.
- > Onyshchenko E., Blandin G., Comas J., Dvoretzky A., **Influence of microalgae wastewater treatment culturing conditions on forward osmosis concentration process**, 2020, *Environmental Science and Pollution Research*, Volume 27, Issue 2, 1234 – 12451.

## Nature-based solutions for water systems

- > Estelrich M., Vosse J., Comas J., Atanasova N., Costa J.C., Gattringer H., Buttiglieri G., **Feasibility of vertical ecosystem for sustainable water treatment and reuse in touristic resorts**, 2021, *Journal of Environmental Management*, Volume 29415, Article number 112968.
- > Castellar J.A.C., Popartan L.A., Pueyo-Ros J., Atanasova N., Langergraber G., Säümel I., Corominas L., Comas J., Acuña V., **Nature-based solutions in the urban context: terminology, classification and scoring for urban**

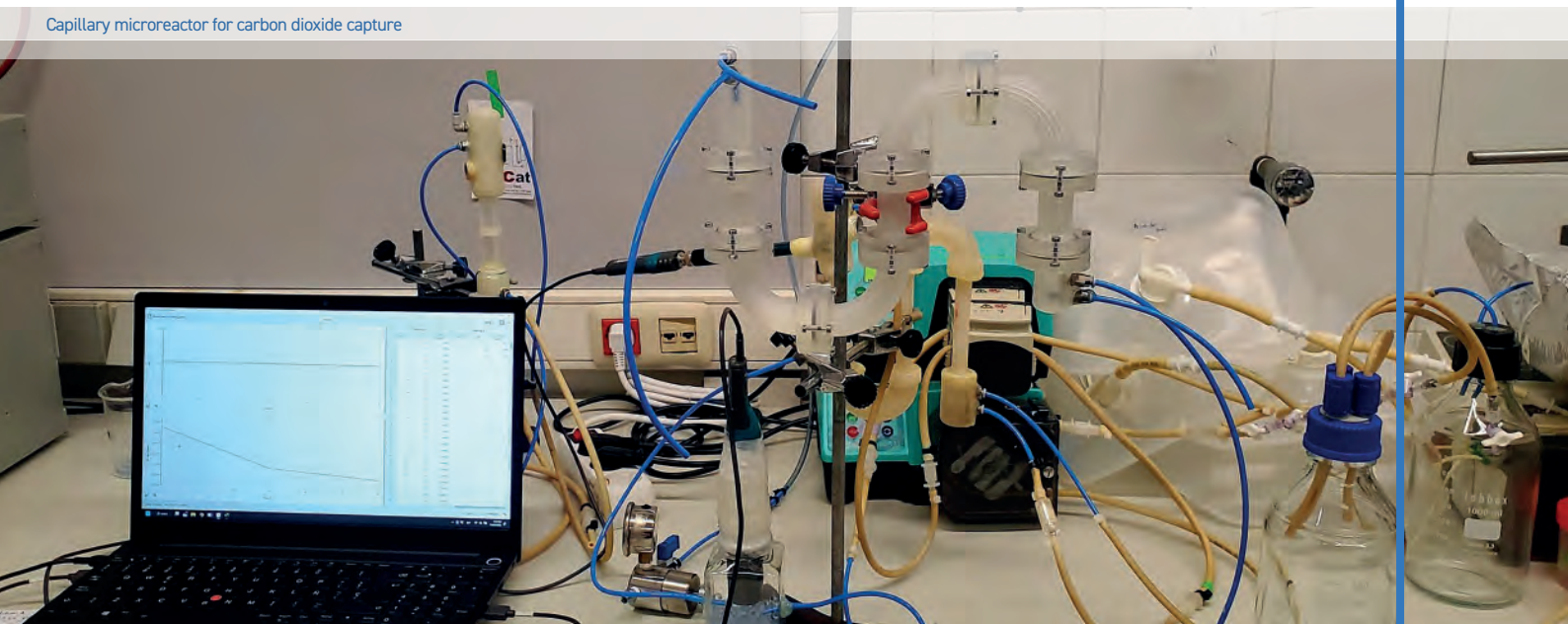
**challenges and ecosystem services**, *Science of the Total Environment*, Open Access, Volume 77920, Article number 146237.

- > Pous N., Barcelona A., Sbardella L., Hidalgo M., Colomer J., Serra T., Salvadó V., **Zooplankton-based reactors for tertiary wastewater treatment: A pilot-scale case study**, *Journal of Environmental Management*, Volume 27815, Article number 111538.
- > Pous N., Hidalgo M., Serra T., Colomer J., Colprim J., Salvadó V., **Assessment of zooplankton-based eco-sustainable wastewater treatment at laboratory scale**, *Chemosphere*, Volume 238, Article number 124683.

## Microbial electrotechnologies for carbon dioxide bioconversion

- > Rovira-Alsina L., Romans-Casas, M., Balaguer M. D., Puig S., Blasco-Gómez R., Romans-Casas M., Bolognesi S., Perona-Vico E., Colprim J., Bañeras L., Balaguer M.D., Puig S., **Thermodynamic approach to foresee experimental CO<sub>2</sub> reduction to organic compounds**, *Bioresource Technology*, Volume 354, June 2022, Article number 127181.
- > Rovira-Alsina, L., Romans-Casas, M., Balaguer, M. D., Puig, S., Blasco-Gómez R., Romans-Casas M., Bolognesi S., Perona-Vico E., Colprim J., Bañeras L., Balaguer M.D., Puig S., **Steering bio-electro recycling of carbon dioxide towards target compounds through novel inoculation and feeding strategies**, 2021, *Journal of Environmental Chemical Engineering*, Volume 9, Issue 4, Article number 105549.
- > Romans-Casas M., Blasco-Gómez R., Colprim J., Balaguer M.D., Puig S., **Bio-electro CO<sub>2</sub> recycling platform based on two separated steps**, 2021, *Journal of Environmental Chemical Engineering*, Open Access, Volume 9, Issue 5, Article number 105909.
- > Rovira-Alsina L., Balaguer M.D., Puig S., **Thermophilic bio-electro carbon dioxide recycling harnessing renewable energy surplus**, *Bioresource Technology*, Open Access, Volume 321, Article number 124423.
- > Dessì P., Rovira-Alsina L., Sánchez C., Dinesh G.K., Tong W., Chatterjee P., Tedesco M., Farràs P., Hamelers H.M.V., Puig S., **Microbial electrosynthesis: Towards sustainable biorefineries for production of green chemicals from CO<sub>2</sub> emissions**, *Biotechnology Advances*, Open Access, Volume 461, Article number 107675.
- > Rovira-Alsina L., Perona-Vico E., Bañeras L., Colprim J., Balaguer M.D., Puig S., **Thermophilic bio-electro CO<sub>2</sub> recycling into organic compounds**, 2020, *Green Chemistry*, Volume 22, Issue 9, Pages 2947 - 29557.
- > Blasco-Gómez, R., Ramió-Pujol, S., Bañeras, L., Colprim, J., Balaguer, M.D., Puig, S., **Unravelling the factors that influence the bio-electrorecycling of carbon dioxide towards biofuels**, 2019, *Green Chemistry*, Volume 21, Issue 3, 2019, Pages 684-691.
- > Batlle-Vilanova, P., Rovira-Alsina, L., Puig, S., Balaguer, M.D., Icaran, P., Monsalvo, V.M., Rogalla, F., Colprim, J., **Biogas upgrading, CO<sub>2</sub> valorisation and economic revaluation of bioelectrochemical systems through anodic chlorine production in the framework of wastewater treatment plants**, 2019, *Science of the Total Environment*, Volume 690, Pages 352-360.

Capillary microreactor for carbon dioxide capture



## Microbial electrotechnologies for water bioremediation

- > Ceballos-Escalera A., Pous N., Balaguer, M. D., Puig, S., **Electrochemical water softening as pretreatment for nitrate electro bioremediation**, *Science of the Total Environment*, February 2022, Volume 8061, Article number 150433.
- > Ceballos-Escalera A., Pous N., Chiluiza-Ramos P., Korth B., Harnisch F., Bañeras L., Balaguer M.D., Puig S. , **Electro-bioremediation of nitrate and arsenite polluted groundwater**, 2021, *Water Research*, Volume 19015, Article number 116748.
- > Pous N., Korth B., Osset-Álvarez M., Balaguer M.D., Harnisch F., Puig S., **Electrifying biotrickling filters for the treatment of aquaponics wastewater**, 2021, *Bioresource Technology*, Volume 319, Article number 124221.
- > Bolognesi S., Cecconet D., Callegari A., Capodaglio A.G., **Bioelectrochemical treatment of municipal solid waste landfill mature leachate and dairy wastewater as co-substrates**, 2021, *Environmental Science and Pollution Research*, Volume 28, Issue 19, Pages 24639 – 24649.
- > Puggioni G., Milia S., Dessì E., Unali V., Pous N., Balaguer M.D., Puig S., Carucci, A., **Combining electro-bioremediation of nitrate in saline groundwater with concomitant chlorine production**, 2021, *Water Research*, Volume 2061, Article number 117736.
- > Osset-Álvarez M., Pous N., Hasan S.W., Naddeo V., Balaguer M.D., Puig S., **Electrified biotrickling filters as tertiary urban wastewater treatment**, 2021, *Case Studies in Chemical and Environmental Engineering*, Volume 4, Article number 100143.





## CONFERENCES

### Scientific events organised

- > **III Foro LEQUIA. Veinticinco Años de ingeniería química y ambiental para abordar los retos del agua de los próximos Veinticinco Años.** Girona. 24/05/2019.
- > **5th European Meeting of the International Society for Microbial Electrochemistry and Technology (ISMET).** 13-15/09/2021. Online event. <https://www.euismet2021.eu/>
- > **IV Fòrum LEQUIA. Per un cycle urbà de l'aigua més resilient.** Girona. 4/11/2022.



### Invited/keynote presentations in scientific events

- > G. Blandin. **Implementation of forward osmosis to transform urban wastewater treatment in resource recovery factory** International Conference on Challenges in Environmental Science and Engineering-CESE2022 (Dubai). 24/11/2022-1/12/2022.
- > Puig, S. **Microbial Electrochemical Technologies for Energy and Resource Recovery from wastewater.** 4th Euro-Mediterranean Conference for Environmental Integration (EMCEI-2022). Sousse (Tunisia). 1-4 November 2022.
- > A. Ceballos-Escalera, **Nitrate electro-bioremediation transition towards on-site pilot plant.** First Symposium for Young Chemists: Innovation and Sustainability, Sapienza University of Rome, 20th-23rd June 2022.
- > L. López. **Indoor CO<sub>2</sub> as renewable carbon source: Coupling indoor CO<sub>2</sub> direct air capture to microbial electrosynthesis technologies.** First Symposium for Young Chemists: Innovation and Sustainability, Sapienza University of Rome, 20th-23rd June 2022.
- > S. Puig. **Microbial electrochemical technology (MET) platform: from electro-bioremediation to electro-fermentation.** Seminar at the Environmental Biotechnology group meeting. Tübingen (Germany). 15/03/2019.

- > S. Puig. **CO<sub>2</sub> as novel feedstock for bulk chemical production**, Workshop "Bioelectrochemical Systems: Key Technologies in the Water-Energy-Nexus". LEITAT, Terrassa (Spain). 12/04/2019.
- > S. Puig. **Niches for Electro bioremediation of contaminated waters**. International society for microbial electrochemistry and technology: International Meeting. Okinawa (Japan). 07-10/10/2019.
- > S. Puig. **Electro bioremediation of contaminated waters**. 5th International Water Industry Conference 2019. 03-06/09/2019. Daegu (Republic of South Korea).
- > S. Puig. **Bioelectrification of industrial biotechnology**, Infoday LIFE Answer "Waste Management in Circular economy framework", Club Mahou, Madrid (Spain). 12/11/2019.
- > S. Puig. **Bio-electro CO<sub>2</sub> recycling into carbon-neutral products**. International Virtual Conference on "CO<sub>2</sub> and Green Technologies". 01-02/07/2020. India.
- > S. Puig. **Avanzando hacia la selectividad del bio-electroreciclaje de CO<sub>2</sub> en productos de alto valor añadido**. 5th workshop of the E3TECH Spanish Excellence Network and 1st IberoAmerican Workshop. 29/10/2020. Online.
- > S. Puig. **Bio-electroreciclaje de CO<sub>2</sub> residual en productos de alto valor añadido**, Webinar de Electroquímica. Escuela de Verano de Electroquímica. Universidad de Santiago de Chile (USACH). 4/12/2020.
- > S. Puig. **Electricity Driven Low Energy and Chemical Input Technology for Accelerated Bioremediation**. Workshop on Innovative technologies for sustainable management of urban and industrial waste streams. Universidad Rey Juan Carlos (Spain). 17/12/2020.
- > Puig, S. and Blasco-Gómez, R. **Avanzando hacia la selectividad del bio-electroreciclaje de CO<sub>2</sub> en productos de alto valor añadido**. V Workshop Iberoamericano a Distancia 'Aplicaciones Medioambientales y Energéticas de la Tecnología Electroquímica. 28-31/10/2020. Online.
- > S. Puig. **Microbial electrosynthesis and solvent production from CO<sub>2</sub>**, Workshop on Biological Carbon Capture and Utilization. University of Natural Resources and Life Sciences - BOKU, Vienna (Austria). 04/05/2021.
- > S. Puig. **Microbial electrosynthesis - Giving a second chance to CO<sub>2</sub>**. European Federation of Biotechnology 2021 Conference. 10-14/05/2021. Online.
- > A. Magrí. **Fonament, implantació i eficiència de les tecnologies de base biològica: nitrificació-desnitrificació**, Jornada Tècnica «Novetats en la tecnologia de tractaments de dejeccions ramaderes». Lleida (Catalonia, Spain). 30/11/2021.



Book of abstracts of EU-ISMET2021 conference

III Foro LEQUIA - May 2019

# PROJECTS



## International projects



### **ELECTRA - Electricity driven Low Energy and Chemical input Technology for Accelerated bioremediation**

**Funding entity:** EC  
**PI:** Dr Sebastià Puig  
**Role:** partner

**Program and call:** H2020-NMBP-TR-IND-2018-2020  
**Duration:** January 2019 – December 2023  
**Reference:** GA 826244

<https://electra.site>



### **WAFRA - Wireless Aquaponic Farming in Remote Areas: A smart adaptive socio-economic solution**

**Funding entity:** AEI  
**PI:** Dr Sebastià Puig  
**Role:** partner

**Program and call:** ERANET MED 2017  
**Duration:** November 2018 – October 2020  
**Reference:** ERANETMED-221

<https://wafra.eng.asu.edu.eg/>



### **EdiciNet - Edible Cities Network - Integrating Edible City Solutions for social resilient and sustainably productive cities**

**Funding entity:** EC  
**PI:** Dr Manel Poch  
**Role:** partner

**Program and call:** H2020-SCC-NBS-2017  
**Duration:** September 2018 – August 2023  
**Reference:** GA 776665

<https://edicinet.com>





### BioRECO<sub>2</sub>VER - Biological routes for CO<sub>2</sub> conversion into chemical building blocks

Funding entity: EC  
PI: Dr Sebastià Puig  
Role: partner

Program and call: H2020-NMBP-BIO-2017  
Duration: January 2018 – December 2021  
Reference: GA 760431

<https://bioreco2ver.eu/>



### INNOQUA - Innovative Ecological on-site Sanitation System for Water and Resource Savings

Funding entity: EC  
PI: Dr Victòria Salvadó  
Role: partner

Program and call: H2020-WATER-2014-20150  
Duration: June 2016 – May 2020  
Reference: GA 689817

<https://innoqua-project.eu>

### SynCorSor4Butanol



### SynCorSor4Butanol – Sustainable Production of n-Butanol by Artificial Consortia Through Synthetic and Systems Biology Approaches

Funding entity: EC  
PI: Dr Lluís Bañeras  
Role: partner

Program and call: ERANETCoBioTech19  
Duration: March 2020 – March 2023  
Reference: ERANETCoBioTech19-31



### INOWASIA - Development of Innovative multilevel formation programs for the new water leading professionals in Southeast Asia

Funding entity: EC  
PI: Dr Ignasi Rodriguez-Roda  
Role: coordinator

Program: EC – Erasmus+ Capacity Building in Higher education  
Duration: January 2021 – January 2024  
Reference: 619225-EPP-1-2020-1-ES-EPPKA2-CBHE-JP

<https://inowasia.com>



### SCALIBUR – Scalable technologies for bio-urban waste recovery

Funding entity: --  
PI: Dr Sebastià Puig  
Role: subcontractor

Program and call: EC – H2020-EU.3.2.4.1  
Duration: November 2018 – October 2022  
Reference: GA 817788

<https://scalibur.eu>

## National projects without business participation

<p><b>WATSON</b></p>	<p><b>WATSON - Toward the development of an EDSS for water treatment works: from basic research to optimal operation at full-scale</b></p> <p><b>Funding entity:</b> AEI  <b>PI:</b> Dr Maria Martín  <b>Role:</b> sole beneficiary</p> <p><b>Program:</b> Proyectos I+D+I "Retos de Investigación"  <b>Duration:</b> January 2018 – December 2020  <b>Reference:</b> CTM2017-83598-R</p>
	<p><b>SHERLOCK - A step forward in the resilient management of drinking water utilities. From applied research to full-scale validation</b></p> <p><b>Funding entity:</b> AEI  <b>PI:</b> Dr Hèctor Monclús  <b>Role:</b> sole beneficiary</p> <p><b>Program:</b> Proyectos I+D+I "Retos de Investigación"  <b>Duration:</b> September 2021 – August 2024  <b>Reference:</b> CTM2017-83598-R</p>
<p><b>COOMET</b></p>	<p><b>COOMET - A second chance to CO<sub>2</sub>: Technological platform based on bioelectrochemical systems</b></p> <p><b>Funding entity:</b> AEI  <b>PIs:</b> Dr Jesús Colprim  Dr Sebastià Puig  <b>Role:</b> sole beneficiary</p> <p><b>Program:</b> Proyectos I+D+I "Retos de Investigación"  <b>Duration:</b> January 2019 – December 2021  <b>Reference:</b> RTI2018-098360-B-I00</p>
<p><b>WatsProof</b></p>	<p><b>WatsProof - Implementation and validation of a decision support system for the control and management of drinking water treatment plants</b></p> <p><b>Funding entity:</b> AEI  <b>PI:</b> Dr Maria Martín  <b>Role:</b> sole beneficiary</p> <p><b>Program:</b> Prueba de concepto  <b>Duration:</b> January 2021 – November 2023  <b>Reference:</b> PDC2021-121655-I00</p>
<p><b>DECEMEM</b></p>	<p><b>DECEMEM - REnd-cap: sustainable membrane technology for decentralized areas</b></p> <p><b>Funding entity:</b> AGAUR  <b>PI:</b> Dr Raquel García  (supervisor: Dr Joaquim Comas)  <b>Role:</b> sole beneficiary</p> <p><b>Program:</b> Innovadors  <b>Duration:</b> September 2020 – March 2022  <b>Reference:</b> INNOV00027</p>
	<p><b>RITA - Urban water cycle resilient to pandemics</b></p> <p><b>Funding entity:</b> AGAUR  <b>PI:</b> Dr Manel Poch  <b>Role:</b> partner</p> <p><b>Program:</b> PANDÈMIES2020  <b>Duration:</b> May 2021 – November 2022  <b>Reference:</b> 2020PANDE00176</p>



### PANGEA - Process intensificAtioN for bioelectroCO<sub>2</sub> recyclinG into carbon-nEutrAl products

**Funding entity:** AEI  
**PIs:** Dr Sebastià Puig  
 Dr Jesús Colprim  
**Role:** sole beneficiary

**Program:** Proyectos de Generación de Conocimiento  
**Duration:** September 2022 – August 2025

**Reference:** PID2021-1262400B-I00



### OSM04LIVES – Giving four lives to osmotic membranes with innovative recycling processes

**Funding entity:** AEI  
**PIs:** Dr Gaëtan Blandin  
 Dr Raquel García  
**Role:** sole beneficiary

**Program:** Proyectos de Generación de Conocimiento  
**Duration:** September 2022 – August 2025

**Reference:** PID2021-1276290A-I00

## CLEPSIDRA

### CLEPSIDRA –Virtual twins for urban water futures: planning scenarios for the hydrosocial cycle

**Funding entity:** AEI  
**PIs:** Dr Ignasi Rodriguez-Roda  
 Dr Manel Poch  
**Role:** sole beneficiary

**Program:** TED2021  
**Duration:** December 2022 – November 2024

**Reference:** TED2021-131862B-I00



### De-CENT - Portable bioelectrochemical modules for decentralised mitigation of CO<sub>2</sub> emissions using surplus energy

**Funding entity:** AEI  
**PIs:** Dr Sebastià Puig  
 Dr Lluís Banyeras  
**Role:** sole beneficiary

**Program:** TED2021  
**Duration:** December 2022 – November 2024

**Reference:** TED2021-129452B-I00



### Electron4Protein - Electricity-driven single-cell protein production

**Funding entity:** AGAUR  
**Scientific entrepreneur:** Dr Narcís Pous  
**Role:** sole beneficiary

**Program:** Llabor2021  
**Duration:** October 2022 – July 2023  
**Reference:** 2021 LLAV 00076



## National projects with business participation

	<p><b>DIGESTAKE – Recovery and valorisation of resources from urban digestates within the framework of circular economy</b></p> <p><b>Funding entity:</b> ACCIÓ  <b>PI:</b> Dr Jesús Colprim  <b>Role:</b> coordinator</p> <p><b>Program:</b> Comunitats RIS3Cat (comunitat Aigua)  <b>Duration:</b> July 2017 – December 2020  <b>Reference:</b> COMRD116-1-0061</p>
	<p><b>REGIREU – Research in water reclamation technologies and risk management for water reuse</b></p> <p><b>Funding entity:</b> ACCIÓ  <b>PI:</b> Dr Joaquim Comas  <b>Role:</b> partner</p> <p><b>Program:</b> Comunitats RIS3Cat (comunitat Aigua)  <b>Duration:</b> July 2017 – December 2020  <b>Reference:</b> COMRD116-1-0062</p>
	<p><b>GAIA - Bioelectroconversion of organic waste streams and CO<sub>2</sub> into sustainable fuels</b></p> <p><b>Funding entity:</b> AEI  <b>PI:</b> Dr Sebastià Puig  <b>Role:</b> partner</p> <p><b>Program:</b> Proyectos de I+D+I en líneas estratégicas  <b>Duration:</b> October 2021 – September 2024  <b>Reference:</b> PLEC2021-007802</p>
	<p><b>HADES - Decision Support System based on Digital Twins for WWTP optimization</b></p> <p><b>Funding entity:</b> AEI  <b>PI:</b> Dr Jesús Colprim  <b>Role:</b> partner</p> <p><b>Program:</b> Proyectos de colaboración público-privada  <b>Duration:</b> March 2022 – February 2025  <b>Reference:</b> CPP2021-009097</p>
<p><b>CONCENTRA</b></p>	<p><b>CONCENTRA - New membrane concentration systems within high VOC concentration ranges to produce PHAs</b></p> <p><b>Funding entity:</b> ACCIÓ  <b>PIs:</b> Dr Gaëtan Blandin  Dr Ignasi Rodríguez-Roda  <b>Role:</b> partner</p> <p><b>Program:</b> Nuclis R+D  <b>Duration:</b> July 2022 – July 2025  <b>Reference:</b> ACE053/22/000081</p>
	<p><b>GiroNat – Twist towards renaturation for a more resilient and healthier Girona</b></p> <p><b>Funding entity:</b> Fundación Biodiversidad  <b>PI:</b> Dr Joaquim Comas  <b>Role:</b> partner</p> <p><b>Program:</b> Renaturalización y resiliencia de ciudades 2021  <b>Duration:</b> September 2022 – September 2025</p>

## KEcoFertilizer

**KEcoFertilizer - Development of a new process for the recovery of potassium struvite for use as a fertiliser with applications in the treatment of pig slurry**

**Funding entity:** DACC  
**PIs:** Dr Jesús Colprim  
 Dr Albert Magrí  
**Role:** subcontractor

**Program:** Grups Operatius  
**Duration:** July 2020 – June 2022

## PROGRAMOX

**PROGRAMOX – Development of an aerobic granular sludge based system for nutrient and organic matter removal from urban wastewater**

**Funding entity:** GS INIMA  
**PIs:** Dr Jesús Colprim  
 Dr Albert Magrí  
**Role:** subcontractor

**Duration:** January 2020 – June 2023



**DrinkIA – Development of an Environmental Decision Support System to optimise drinking water treatment plants and distribution networks**

**Funding entities:** ATL, FISERSA, CREATECH360°  
**PI:** Dr Hèctor Monclús  
**Role:** subcontractor

## Postdoctoral fellowships\_\_\_\_\_



**ATMOSPHERE - Advanced Technology for Microbial Electro-Synthesis of Platform cHemicals and Efficient in-situ Recovery via Electrodialysis**

**Funding entity:** EC  
**PI:** Dr Paolo Dessì

**Program:** MSCA-IF  
**Duration:** February 2022 – January 2024



**The MICRO-BIO process: a comprehensive platform to capture CO<sub>2</sub> from indoor air, transform it into valuable carbon-neutral commodity chemicals**

**Funding entity:** EC  
**PI:** Dr Luis López

**Program:** MSCA-IF  
**Duration:** February 2022 – January 2024



### Forward Factory - Implementation of forward osmosis membrane technology to transform urban wastewater treatment in resource recovery factory

**Funding entity:** La Caixa Foundation  
**PI:** Dr Gaëtan Blandin

**Program:** Junior Retaining Leader (COFUND)  
**Duration:** October 2022 – September 2025

### CO<sub>2</sub>BioFuels

#### CO<sub>2</sub>BioFuels - Microbial Electrosynthesis of Biofuels from CO<sub>2</sub>

**Funding entity:** ACCIÓ  
**PI:** Dr Helena Matabosch  
(supervisor: Sebastià Puig)

**Program:** TECNIOSpring + (COFUND)  
**Duration:** October 2019 – September 2021

**Reference:** TECSPR18-1-0101

### MEM 2.0

#### Mem 2.0 - Integration of recycled membranes in water processes

**Funding entity:** ACCIÓ (COFUND)  
**PI:** Dr Raquel García  
(supervisor: Dr Joaquim Comas)

**Program:** TECNIOSpring+  
**Duration:** June 2018 – May 2020

**Reference:** TECSPR17-1-0019

### SILCAP

#### SILCAP - Selective siloxane capture for indoor pco

**Funding entity:** ACCIÓ (COFUND)  
**PI:** Dr Alba Cabrera  
(supervisor: Dr Maria Martín)

**Program:** TECNIOSpring+  
**Duration:** December 2017 – November 2019

**Reference:** TECSPR16-1-0045

## Technology platforms, networks and associations



### Comunitat RIS3CatAigua



### COST Action "Circular City Re.Solution"



COST Action “Protection, Resilience, Rehabilitation of damaged environment” (PHOENIX)



COST Action “Cross Border Transfer and Development of Sustainable Resource Recovery Strategies Towards Zero Waste” (FULL RECO4US)”



Xarxa R+D+I “Energy for the Society”



Xarxa Marítima de Catalunya “BlueNetCat”



CWP - Catalan Water Partnership



PTEA – Plataforma Tecnológica Española del Agua



META – Mesa Española de Tratamiento de Aguas

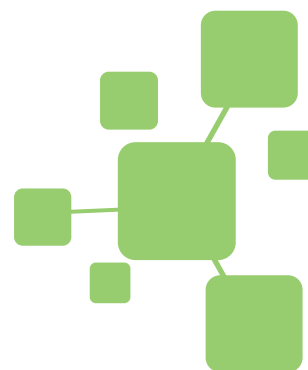


International Water Association (IWA) Specialist Groups



## TECHNOLOGY TRANSFER

Technology transfer has always been a priority in our group. In addition to the high number of RDI projects and technology transfer contracts, during 2019-2022 LEQUIA researchers have supervised industrial doctorates, filed several patents as co-inventors, and co-founded one spinoff company.



## Expertise

### Biological treatment and resource recovery from wastewater

- > Technologies anammox and partial nitrification to remove nitrogen from wastewater
- > Struvite and k-struvite precipitation for phosphorous recovery
- > Panammox® process to treat landfill leachates
- > Biminex® process to reduce excess sludge in WWTPs
- > Sanitation reactor by filtration with Daphnia

### Bioelectrochemical systems

- > Bioremediation of water contaminated with nitrates and sulphates
- > Bioconversion of CO<sub>2</sub> into added value compounds
- > Biogas upgrading
- > Removal of nitrogen and organic matter from wastewater
- > Operational parameters, design and scale-up of bioelectrochemical systems
- > Electricity-driven single-cell protein production

### Advanced adsorption and oxidation processes

- > Analysis of contaminant gases
- > Analysis of odour causing compounds
- > Adsorption processes for gas and water treatment
- > Biogas upgrading: removal of siloxanes and organic volatile compounds
- > Modification of activated carbon to obtain new adsorbents
- > Thermal and oxidative regeneration of adsorbents

### Membranes for water treatment

- > Fouling and clogging phenomena
- > Integration of membrane bioreactors (MBR) at different scales
- > Monitoring and automatic control
- > Removal of pharmaceutical compounds from wastewater
- > Decision Support Systems (DSS) for the integrated supervision of MBRs
- > Application of MBRs to gas treatment
- > Osmotic MBRs for wastewater treatment
- > Recycling of reverse osmosis membranes for water treatment





Wastewater treatment plant of Montornès del Vallès (Barcelona)



Wastewater treatment plant of Riu Sec in Sabadell (Barcelona)

### Environmental Decision Support Systems

- > Multi-criteria Environmental Decision Support Systems (EDSS) in the water cycle
- > Integration of artificial intelligence and modelling in EDSS to manage complex systems: software Novedar\_EDSS (design of WWTPs) and DrinkIA (operation of drinking water treatment plants)
- > Life Cycle Assessment (LCA) of sanitation systems
- > Integrated control of urban water cycle. Knowledge-based modelling of operational microbiological problems in wastewater treatment

### Socio-natural systems

- > Study of the ethic and political dimension of technologies
- > Urban planning, circular economy and urban transitions
- > The hydro-social cycle: decision making and conflicts associated with the urban water cycle and its governance

## Patents and utility models

- > Automated real time control system for membrane bioreactors Smart Air MBR®. Universitat de Girona, OHL Medio Ambiente INIMA SAU. Inventors: Rodriguez-Roda, J. Comas, M. Poch, G. Ferrero, J. Sipma, P. Clara, S. Rovira, H. Monclús, J. Canals. ES2333837B1.
- > Bioelectrochemical system for water treatment. Universitat de Girona. Inventors: J. Colprim, M.D. Balaguer; S. Puig, N. Pous. EP2925679B1.
- > Reactor for wastewater treatment. Universitat de Girona, Inbrooll Ind S.L. Inventors: V. Salvadó, T. Serra, J. Colomer, N. Pous, M. Font, I. Pijoan, J. Scheerer. ES1234189U.

## Entrepreneurship



In 2022, LEQUIA and ICRA researchers founded spinoff company **Ecomemb** devoted to the recycling of membranes for water treatment. **Ecomemb** collects discarded filters from large

seawater desalination plants, treats them, and sells them to other types of smaller facilities, which treat water for irrigation, industrial processes and wastewater, among others.

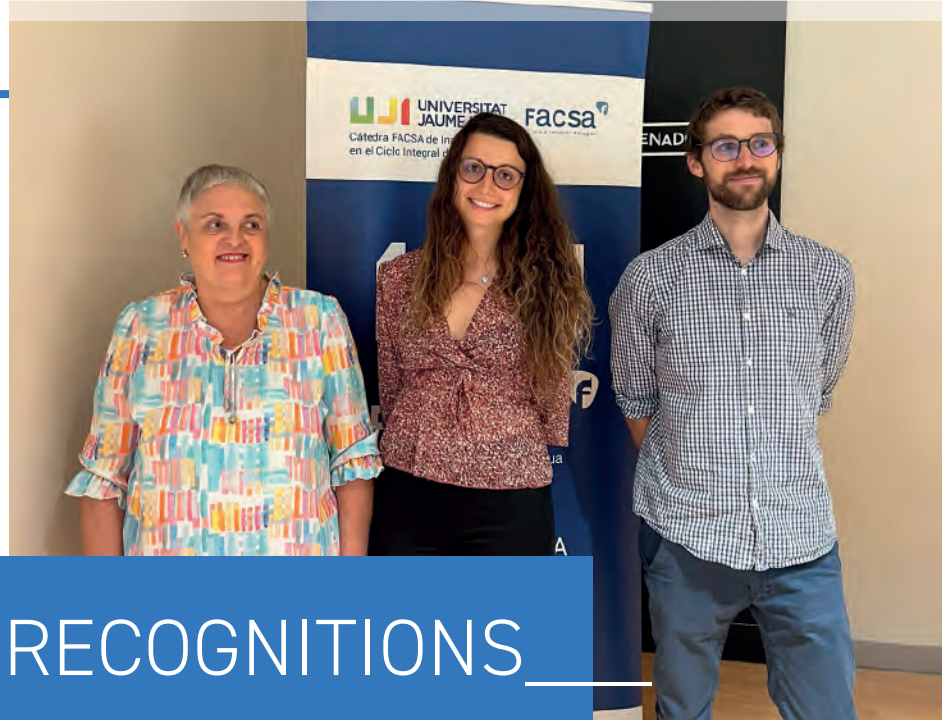
[www.recycledmembranes.com](http://www.recycledmembranes.com)

## Industrial doctorates

- > The socio-cognitive dimension of water: the politisation of water in Barcelona. Organisation: CETAQUA
- > Development of strategies for waste valorisation in wastewater treatment plants (WWTPS): Consorci Besòs Tordera case study. Organisation: Consorci Besòs-Tordera
- > Use of modelling hydrodynamic tools for the optimization of wastewater treatment plants. Organisation: ACCIONA
- > Optimization of ozonization step in Figueres drinking water treatment plant by means of artificial intelligence techniques. Organisation: FISERSA
- > Application of AGS and anammox technology to low load energy sustainable systems. Organisation: GS INIMA
- > Analysis and improvement of user's satisfaction in urban water cycle service. Organisation: Aigües de Barcelona.

## Some of our partners





## AWARDS AND RECOGNITIONS

### Recognitions to researchers

- > In 2020 Sebastià Puig was recognised by **ICREA Academia** award by the Catalan Institution for Research and Advanced Studies (ICREA), Spain.
- > In 2020 Sebastià Puig was finalist of **Suschem-Spain Award to Young Chemists** for his work "Bioelectrochemical systems: from carbon dioxide to added value products" in collaboration with company Aqualia.
- > In 2020 Laura Rovira was selected as one of the 25 young winning scientists of **Green Talent Competition 2020**. Hosted by German Federal Ministry of Education and Research, this competition promotes the international exchange of innovative green ideas from various fields of research.
- > In 2021 Raquel García was awarded with **Botín Foundation award to Sustainable Water Management** for her work on the recycling of reverse osmosis membranes for water treatment.

### Doctoral theses

- > Ramiro Blasco's doctoral thesis "Steering CO<sub>2</sub> bioelectrorecycling into valuable compounds through inline monitoring of key operational parameters" defended on 22/06/2020 was awarded with the **Extraordinary PhD Prize 2020 of UdG Doctoral Programme in Water Science and Technology**.
- > Giulia Puggioni's doctoral thesis "Remediation of multi-contaminated groundwater using bioelectrochemical systems" defended on 22/03/2022 was awarded by the **2nd edition of the Mediterranean PhD School on «European Green Deal. The Contribution from Civil, Architectural and Environmental Engineering 2021»**.
- > Lluís Godo's doctoral thesis "Design and implementation of an EDSS for the control and management of DWTPs" defended on 05/11/2020 was awarded with the **2022 Prize to Best Doctoral Thesis by University Jaume I Chair FACSA on innovation of integrated urban water cycle**.



## Bachelor/Master research works

- > Emma Company's Bachelor research work "Bio-induced mineraliation of calcium and magnesium phosphates in anammox reactors: process operation and study of microbial community" was awarded with the **2022 Prize to Best Bachelor research work by University Jaume I Chair FACSA on innovation of integrated urban water cycle.**
- > Meritxell Romans' Bachelor research work "Progressing towards the reduction of time to set up CO<sub>2</sub> biologic electro-recycling systems" was awarded with **Premis Sant Jordi 2020- Premis de la Societat Catalana de Tecnologia (per a estudiantsfor students)" by Institut d'Estudis Catalans.**
- > Bàrbara Rosselló's Bachelor research work "Volatile fatty acids concentration in real wastewater by forward osmosis" was awarded with the **2019 Prize to Best Bachelor research work by University Jaume I Chair FACSA on innovation of integrated urban water cycle.**



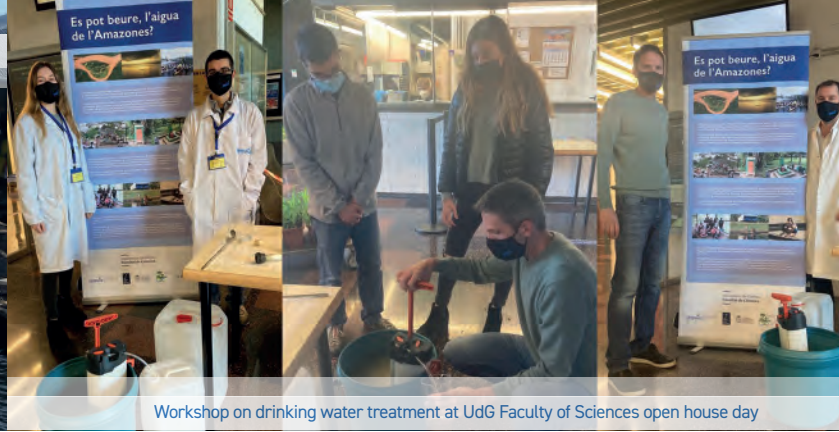
Raquel García at Fundación Botín award ceremony

## Conferences

- > Development of a NOM related environmental decision support system for drinking water treatment plants, by J. Suquet, L. Godo-Pla, M. Verdaguier, M.J. Martin, M. Poch, H. Monclús. **Best poster presentation (1<sup>st</sup> prize) at WATERMATEX 2019 (10th IWA Symposium on Modelling and Integrated Assessment).** Lund (Sweden) and Copenhagen (Denmark). 01-04/09/2019.
- > Fuzzy expert system for controlling the primary disinfection in a drinking water treatment plant, by L. Godo-Pla, P. Emiliano, F. Valero, J. Suquet, M. Martín, M. Poch, H. Monclús. **Best poster presentation (2<sup>nd</sup> prize) at WATERMATEX 2019 (10th IWA Symposium on Modelling and Integrated Assessment).** Lund (Sweden) and Copenhagen (Denmark). 01-04/09/2019.
- > Adsorption technology for the abatement of volatile methylsiloxanes, by Alba Cabrera. **Best presentation at 8th IWA Odour & VOC Air Emissions Conference 2019.** Hangzhou, China. 14-17/10/2019.
- > Thermophilic bio-electro CO<sub>2</sub> recycling harnessing renewable energy surplus, by Laura Rovira. **Best poster and flash presentation at 1st Virtual Meeting of the International Society for Microbial Electrochemistry and Technology.** 07-09/10/2020.
- > Electrifying biotrickling filters for the treatment of aquaponics wastewater, by Narcís Pous – **Best presentation award of V European Meeting of the International Society for Microbial Electrochemistry and Technology (EU-ISMET 2021).** 13-15/09/2021.
- > Alba Ceballos-Escalera was awarded with the Prize to the Best Presentation of the **"First Symposium for Young Chemists: Innovation and Sustainability"** (SYNC2022, Rome).

## Projects

- > Project INNOQUA is one of top ten innovations awarded at the **INNOVATION VILLAGE 2019 in Napoli, Italy.**
- > According to the EU Innovation Radar Platform, LEQUIA contributions to **EU projects BioRECO<sub>2</sub>VER and ELECTRA are cutting-edge EU-funded innovations.**
- > Ecomemb entrepreneurship project has been recognised as **Impact Business initiative 2021** by Ship2Business Foundation.



Workshop on drinking water treatment at UdG Faculty of Sciences open house day

## OUTREACH

### Outreach activities

The dissemination of research to different audiences is part of LEQUIA's mission. Our specific objectives include encouraging primary and high school students to choose degree programmes in sciences, organising activities in the water science field and promoting LEQUIA research activity by means of outreach activities. Every year, LEQUIA takes part in several dissemination activities, individually or as a research group of the University of Girona.

#### Types of activities:

- > Open house activities
- > Fairs and exhibitions
- > Internships and programs for secondary school students
- > Non-specialised media (press, TV, radio)
- > Workshops and conferences for non-specialised audiences
- > LEQUIA's own dissemination programmes and initiatives

#### Our main audience:

- > Primary and secondary school students
- > Secondary school teachers
- > Girona and Catalan society

#### Dissemination of microbial electrotechnologies to high schools

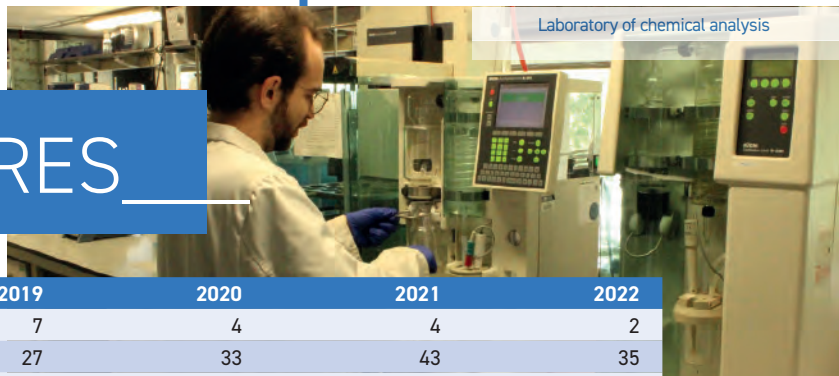
During 2019-2010 and 2020-2021 academic terms, LEQUIA researchers trained fifteen high school teachers of Girona province on microbial electrotechnologies. The teachers transferred this knowledge to their pupils and issued a challenge: design a bioelectrochemical system to treat contaminated water. This activity was carried out to disseminate EU-ISMET conference on microbial electrotechnologies taking place in Girona in 2021.

## INTERNATIONAL COOPERATION FOR DEVELOPMENT

AMAZO-MEM – Sustainable decentralised membrane system for drinking water treatment in Amazon river

communities. Funding entity: UdG Cooperation Office. Duration: 2019-2021. PI: Dr Ignasi Rodriguez-Roda.

## FACTS AND FIGURES



	2019	2020	2021	2022
PhD dissertations defended	7	4	4	2
Peer reviewed publications*	27	33	43	35
Turnover	1.486.862 €	1.130.032 €	1.547.856 €	2.113.969 €
Patents filed		1		
R&D and innovation contracts and services	195.865 €	172.496 €	392.741 €	353.620 €
% Non competitive funds	13%	15%	25%	17%
Spinoff companies				1

\* Source: Scopus





# CONTACT

Girona Science Park



Faculty of Sciences – University of Girona



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