Felipe Antonio Carreño López

Ph.D. in Engineering Sciences | Chemical Engineer

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Professional Summary

I hold a Ph.D. in Engineering Sciences (*Summa cum laude*) and a professional degree in Chemical Engineering, and I specialise in computational fluid dynamics (CFD) applied to chemical and environmental processes. I am currently a postdoctoral researcher at Universidad de los Andes (Chile), where I lead, as **Principal Investigator**, the **FONDECYT Postdoctoral Grant No. 3250412** (awarded, 2025–2028), aimed at characterising biofilm and elemental sulfur dynamics in fixed-bed reactors for the autotrophic denitrification of groundwater, by coupling CFD simulations with advanced digital imaging techniques.

Throughout my career I have applied these tools to a broad range of problems, from the biofiltration of gaseous pollutants to soil bioremediation and the multiphase simulation of cementitious materials. This commitment to multidisciplinary work is reflected in publications in high-impact WoS-indexed journals (Q1–Q2) and in international collaborations with the University of California, Davis, and the University of Valladolid, aimed at strengthening research networks and developing sustainable processes.

On the teaching side, I am the instructor of record for Advanced Design of Chemical and Biochemical Reactors, and I have taught fluid modelling, fluid mechanics and CFD simulation at both undergraduate and graduate level. I have supervised or co-supervised seven undergraduate and M.Sc. theses, and I complement this work with a Graduate Diploma in University Teaching, reflecting my commitment to meaningful, student-centred education.

I have also promoted technology transfer as the founder of a science- and technology-based company in water desalination and through awarded innovation grants. In the short term, I aim to consolidate an independent research line through a FONDECYT Iniciación grant devoted to building digital twins from CFD simulations for reactor operation and design, and later to extend these tools to natural aquatic systems such as lakes and rivers. As a teacher and researcher, my goal is to place multidisciplinary engineering at the service of society, developing and transferring tools that help mitigate air, soil and water pollution.

Curriculum Vitae

Education

Ph.D. in Engineering Sciences *2018–2023*

Universidad de los Andes, Santiago, Chile

- **Advisors**: Dr. Patricio Moreno & Dr. Alberto Vergara
- **Dissertation**: A novel fluid dynamic study of the gas-liquid flows in biotrickling filters through CFD simulations and digital imaging techniques.
- **Distinction**: Summa cum laude.

B.Sc. & Professional Degree in Chemical Engineering *2010–2017*

Universidad de Santiago de Chile, Santiago, Chile

- **Advisor**: Dr. Luis Díaz Robles
- **Thesis**: Fluid-dynamic modelling and simulation of a batch reactor under subcritical water conditions.

Graduate Diploma in University Teaching *2024–2025*

Universidad de los Andes, Santiago, Chile

Research Experience

Principal Investigator — Postdoctoral Researcher *Apr. 2024–Present*

School of Engineering and Applied Sciences, Universidad de los Andes, Santiago, Chile

- FONDECYT Postdoctoral Grant 2025 No. 3250412: *Assessing Biofilm and Elemental Sulfur Dynamics in a Groundwater Elemental Sulfur-based Autotrophic Denitrification Fixed Bed Reactor through CFD Simulations coupled with Digital Imaging Techniques*.
- Sponsoring researcher: Dr. César Huiliñir.

Visiting Researcher *Sep.–Dec. 2023*

Tahoe Environmental Research Center, University of California, Davis, Davis, United States

- FOVI220094: *Study of the rheology of cementitious materials for the development of more sustainable and durable concrete infrastructure*.
- Advisors: Dr. Patricio Moreno, Dr. Álvaro Paul & Dr. Fabián Bombardelli.
- Collaboration with Dr. Verónica L. Morales' group on CFD modelling of *bioclogging* (flow, mixing and reactive transport in porous media under progressive biomass accumulation), which gave rise to two manuscripts in preparation for *Environmental Science & Technology* (Q1).
- Collaborative proposal submitted to the American Chemical Society Petroleum Research Fund: *Microbial Modulation of Multiphase Flow in Complex Geologic Media: Mechanistic Insights into Bioclogging and Flow Rerouting* (under evaluation).

Visiting Researcher *Jan.–Aug. 2020*

Institute of Sustainable Processes, University of Valladolid, Valladolid, Spain

- REDES190137 (CONICYT): Programme for the Support of International Research Networks between Research Centres 2019.
- Advisors: Dr. Alberto Vergara, Dr. Patricio Moreno & Dr. Raúl Muñoz.

Doctoral Researcher *2019–2022*

School of Engineering and Applied Sciences, Universidad de los Andes, Santiago, Chile

- FONDECYT Regular 1190521: *Engineering a microbial community for the biofiltration of phenanthrene vapor biodegradation.*
- Advisor: Dr. Alberto Vergara.

Undergraduate Researcher *2016–2017*

Department of Chemical Engineering, Universidad de Santiago de Chile, Santiago, Chile

- Project BMBF ID15I10580: *Investigation and optimization of high energetic density hydrophobic pellet production, through hydrothermal carbonization with different biomass mixtures of national relevance.*
- Advisors: Dr. Luis Díaz Robles & Dr. Patricio Moreno.

Professional Experience

Postdoctoral Researcher *2024–Present*

School of Engineering and Applied Sciences, Universidad de los Andes, Santiago, Chile

- FAI Postdoctoral Fellowship 2024 and, subsequently, FONDECYT Postdoctoral Grant 2025 No. 3250412.

Chief Technology Officer *2022–2024*

ASOKA SpA, Santiago, Chile

- Founder of a science- and technology-based company devoted to the development of disruptive water desalination technologies.

Research Assistant *2023*

School of Engineering and Applied Sciences, Universidad de los Andes, Santiago, Chile

- Support to Dr. Patricio Moreno on multiphase simulations within the project *Assessing Fiber Orientation and Distribution in Ultra-High-Performance Concrete (UHPC) through Advanced Computational Modeling and Experimental Analysis*, also contributing to the training of undergraduate and graduate students.

Publications

h-index: 2 · 30 citations · 4 indexed documents (WoS).

Peer-reviewed articles in indexed journals (WoS)

[1] Yánez, D., Manterola, J., Guerrero, L., **Carreño-López, F. A.**, Huiliñir, C. (2026). Enhancing sulfur-based denitrification with natural zeolite: performance under autotrophic and mixotrophic operation. *Biodegradation* (Q1, IF: 4.2), 37(4), 128. https://doi.org/10.1007/s10532-026-10352-4

[2] **Carreño-López, F. A.**, Moreno-Casas, P. A., Scott, F., Vergara-Fernández, A., Sierra-Pallares, J., Muñoz, R. (2026). Hybrid section-based modeling of gas-phase hydrodynamics in biotrickling filters: Influence of packing material on residence time distributions. *Biochemical Engineering Journal* (Q2, IF: 3.7), 227, 110049. https://doi.org/10.1016/j.bej.2025.110049

[3] **Carreño-López, F. A.**, Moreno-Casas, P. A., Scott, F., Iza, J., Sierra-Pallares, J., Muñoz, R., Vergara-Fernández, A. (2023). A convenient method to validate the gas flow of a CFD–CT simulation applied to a packed bed used in gas biofiltration through residence time distributions. *Chemical Engineering Journal* (Q1, IF: 15.1), 451(4), 138795. https://doi.org/10.1016/j.cej.2022.138795

[4] Vergara-Fernández, A., Scott, F., **Carreño-López, F. A.**, Aroca, G., Moreno-Casas, P. A., González-Sánchez, A., Muñoz, R. (2020). A comparative assessment of the performance of fungal–bacterial and fungal biofilters for methane abatement. *Journal of Environmental Chemical Engineering* (Q1, IF: 7.4), 8(5), 104421. https://doi.org/10.1016/j.jece.2020.104421

Articles in preparation

[1] Vargas Lara, J. L., Khoshtarash, H., **Carreño-López, F. A.**, Al-Zghoul, B. M., Fadely, E. C., Peña, J., Ahadiyan, H., Roche, K., Bombardelli, F. A., Morales, V. L. (2026). Flow, Mixing, and Reaction Dynamics in Progressively Bioclogged Porous Media. In preparation for submission to *Environ. Sci. Technol.* (Q1, IF: 11.4)

[2] Khoshtarash, H., Vargas Lara, J. L., **Carreño-López, F. A.**, Al-Zghoul, B. M., Fadely, E. C., Peña, J., Morales, V. L. (2026). Sensitivity analysis of biofilm permeability and progressive biomass accumulation on flow and transport in a bioclogged porous medium. In preparation for submission to *Environ. Sci. Technol.* (Q1, IF: 11.4)

Conference Presentations

InterPore 2026 *19–22 May 2026*

Living Porous Media: Uncovering the Microbe-Fluid-Rock Interactions That Reshape Subsurface Transport *(poster)* · *Université de Nantes, Nantes, France*

XXII Chilean Congress of Chemical Engineering *27–30 Oct. 2025*

CFD simulation of an elemental sulfur packed-bed biofilter applied to autotrophic denitrification *(poster and oral presentation)* · *Pontificia Universidad Católica de Valparaíso, Chile*

AGU Annual Meeting 2024 *9–13 Dec. 2024*

Evolution of Biofilm Permeability and Pore-Scale Hydrodynamics in a Progressively Bioclogged Sandy Medium *(poster) · AGU, Walter E. Washington Convention Center, Washington D.C., United States*

XXII Chilean Congress of Computational Mechanics *3–4 Oct. 2024*

A novel validation of the gas flow in a CFD–CT simulation of packed bed biofilters through residence time distributions *(oral presentation) · Pontificia Universidad Católica de Valparaíso, Chile*

Awarded Research Funding

FONDECYT Postdoctoral Grant No. 3250412 *2025–2028*

Principal Investigator, ANID · *$93,492,000 CLP*

Semilla Inicia 22INI2-239253 *2023*

Chilean Economic Development Agency (CORFO) · *$15,000,000 CLP*

Brain Chile 2023 (2nd place) *2023*

Anacleto Angelini Innovation Center, Pontificia Universidad Católica de Chile · *$14,000,000 CLP*

Awards and Honors

National Doctoral Scholarship *2021*

National Agency for Research and Development (ANID)

FAI Doctoral Scholarship *2018*

Universidad de los Andes

Patents

[1] Ugarte, C., Cruz, R. & **Carreño, F. A.** Seawater desalination system and method. Patent No. 202302685, INAPI (Chilean National Institute of Industrial Property), Santiago, Chile.

Teaching Experience

Instructor of record for 4 courses (10 offerings in total) and teaching assistant for 3 courses (5 offerings), at undergraduate and graduate level in Engineering.

INSTRUCTOR OF RECORD

Advanced Design of Chemical and Biochemical Reactors *2022–2026*

Taught 5 times (2nd sem. 2022, 2nd sem. 2023, 2nd sem. 2024, 2nd sem. 2025, 1st sem. 2026) · *Universidad de los Andes*

Fluid Modelling *2023–2024*

Taught twice (1st sem. 2023, 1st sem. 2024) · *Universidad de los Andes*

CFD Simulation of Multiphase Flows *2022*

Universidad de los Andes

Fluid Mechanics *2023–2024*

Laboratory instructor. Taught twice (1st sem. 2023, 1st sem. 2024) · *Universidad Andrés Bello*

TEACHING ASSISTANT

Simulation *2018–2019*

Taught 3 times (2nd sem. 2018, 1st sem. 2019, 2nd sem. 2019) · *Universidad de los Andes*

Numerical Solutions of Environmental Engineering Problems *2020*

Universidad de los Andes

Introduction to Turbulent Flow Modelling *2020*

Universidad de los Andes

Thesis Supervision

Cristóbal Núñez, Chemical Engineering *2026–Present*

Co-advisor (advisor: Dr. César Huiliñir). Effect of the presence of emerging contaminants on the autotrophic denitrification process in biofilters applied to groundwater treatment · *Universidad de los Andes*

Sara Stevanovic, Chemical Engineering *2026–Present*

Advisor. Development of a proper orthogonal decomposition reduced-order model, driven by CFD simulations of random packed beds, to study geometric design parameters in an elemental sulfur autotrophic denitrification biofilter · *Universidad de los Andes*

Javiera Riderelli, Chemical Engineering *2026–Present*

Advisor. Assessing the fate of nitrogen discharges in Lake Llanquihue by coupling reactive transport to the three-dimensional hydrodynamic model Si3D · *Universidad de los Andes*

Santiago Vila, Chemical Engineering *2025–2026*

Co-advisor (advisor: Dr. César Huiliñir). Start-up and operational assessment of an elemental sulfur autotrophic denitrifying biofilter for nitrate removal from groundwater · *Universidad de los Andes*

Samuel Abogabir Schacht, Environmental Engineering *2025–2026*

Advisor (co-advisor: Dr. César Huiliñir). Development and experimental validation of a three-dimensional CFD model of a fixed-bed reactor applied to elemental sulfur autotrophic denitrification through residence time distribution analysis · *Universidad de los Andes*

Andrés Orellana Molnar, Environmental Engineering *2025–2026*

Advisor (co-advisor: Dr. César Huiliñir). Modelling and simulation of an autotrophic denitrifying biofilm using S^0 as electron donor · *Universidad de los Andes*

Amparo Melgarejo Araya, M.Sc. in Engineering Sciences *2024–2025*

Co-advisor (advisor: Dr. Sichem Guerrero). CO_2 hydrogenation for methanol production over CeO_2- and TiO_2-supported catalysts with Zn, Co and Fe active phases · *Universidad de los Andes*

Juan Iturralde Spiniello, Environmental Engineering *2022–2023*

Co-advisor (advisor: Dr. Felipe Scott). Development of a turbidostat controlled by a low-cost optical density sensor for the growth and evolution of methylotrophs · *Universidad de los Andes*

Natalia Fernández Sepúlveda, Environmental Engineering *2022–2023*

Co-advisor (advisor: Dr. Felipe Scott). Development and demonstration of a methanol feeding control system for methylotrophic cultures in a bioreactor · *Universidad de los Andes*

Skills

Simulation	OpenFOAM, Ansys Fluent, LIGGGHTS, CFDEM, Salome, MeshLab, cfMesh
Programming	Python, C++, MATLAB, GNU Bash
Tools	Microsoft Office, LaTeX, Inkscape, Notion
Languages	Spanish (native) · English (advanced)