

RESEARCH PORTFOLIO

Anammox-based autotrophic nitrogen removal from wastewater

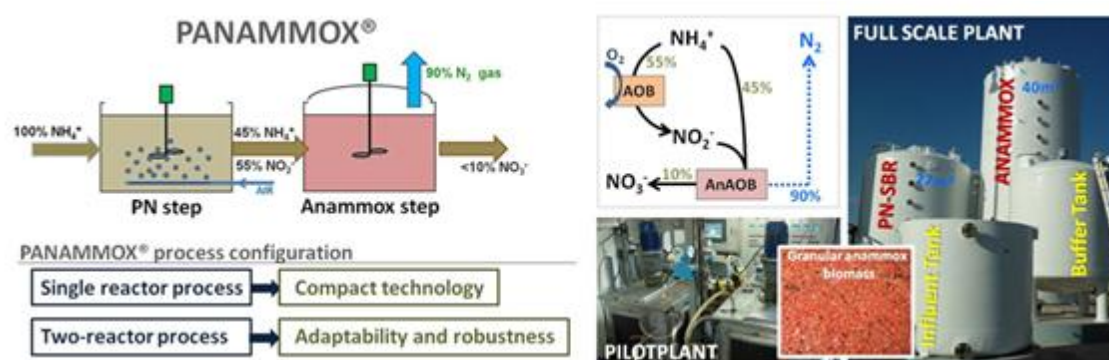
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Name of scientists in charge

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Technology description

- > Autotrophic nitrogen removal from ammonium high- and low-loaded wastewater.
- > Improvement of the N-removal process efficiency in existing facilities.
- > Energy-efficient technology.
- > Reduction of treatment costs (low aeration, avoidance of organic-C dosage, removal of alkalinity and bCOD).



Overview of the PNA technology: scheme, process configuration and wastewater treatment pilot- and full-scale plants

Research expertise

- > Development of processes for autotrophic N-removal based on anaerobic ammonium oxidation (anammox).
- > Expertise on conditioning high N-strength wastewater with highly variable characteristics previous to anammox reactors. Know-how on the start-up and long-term operation of PN-SBRs. Know-how on denitrification via nitrite.
- > Expertise on process design, configuration and operation for wastewater treatment (mainstream and sidestream in WWTPs, leachate, livestock manure). Scalability. Studies on process automation. Either 2-step or 1-step PNA configuration. PANAMMOX® technology.
- > Studies concerning treatment of wastewater with high ammonium content, conductivity, COD (both refractory and biodegradable) and complex matrix.
- > Studies concerning development of advanced wastewater treatment solutions by combining PNA with other technologies (such as advanced oxidation processes (AOPs)).
- > Modelling and process simulation including computational fluid dynamics (CFD).
- > Studies concerning mechanisms triggering gas emissions and quantification of nitrous oxide (N₂O).
- > Identification of microbial populations through molecular techniques (NGS, FISH, PCR, qPCR).
- > Phosphate bio-induced precipitation together with the PNA process aiming at phosphorus recovery.

Projects

- > **SPORE-MED** - Sustainable uPgraded WWTPs for resORce recovery, water Reuse and hEalth surveillance in the MEDiterranean region. PRIMA Foundation. PRIMA-Section 1-Water Management-Call 2023-Topic 1.1.1. GA 2322. 2024-2027. Role: coordinating entity.
- > **HADES** - Decision Support System based on Digital Twins for WWTP optimization. Agencia Estatal de Investigación. CPP2021-009097. Proyectos de Colaboración Público-Privada 2022-2024. Ref CPP2021-009097. Role: partner.
- > **LechoGranular** - Desarrollo de sistema basado en fango aeróbico granular (AGS) para la eliminación de nutrientes y materia orgánica en el tratamiento de aguas residuales urbanas. GS Inima (CDTI project). 2020-2023. Role: subcontracting entity.
- > **DigesTake** - Recovery of resources from urban digestates within the framework of the circular economy. ACCIÓ-Generalitat de Catalunya. RIS3CAT "Comunitat Aigua". Ref: COMRDI16-1-0061. 2017-2020. Role: coordinating entity.
- > **TreatREC** - Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges. European Commission. H2020 - MSCA - ITN – 2014. GA: 642904. 2015-2018. Role: partner

Publications

- > Carbó, O., Teixidó, J., Canals, J., Ordóñez, A., Magrí, A., Baldi, M., Gutiérrez, B., Colprim, J., (2024) **Achieving mainstream partial nitrification with aerobic granular sludge treating high-rate activated sludge effluent**, *Journal of Water Process Engineering*, 60, 105165.
- > Magrí A., Rusalleda M., Vilà A., Akaboci T.R.V., Balaguer M.D., Llenas J.M., Colprim J. (2021). **Scaling-up and long-term operation of a full-scale two-stage partial nitrification-anammox system treating landfill leachate**, *Processes* 9(5), 800.
- > Magrí A., Company E., Gich F., Colprim J. (2021). **Hydroxyapatite formation in a single-stage anammox-based batch treatment system: reactor performance, phosphorus recovery, and microbial community**, *ACS Sustainable Chemistry and Engineering* 9(7), 2745-2761.
- > Waki M., Yasuda T., Fukumoto Y., Béline F., Magrí A. (2020). **Numerical assessment of nitrogen removal from swine wastewater in activated sludge systems: Comparison between continuous and intermittent aeration**, *Bioresource Technology Reports* 11, 100492.
- > Akaboci T.R.V., Rusalleda M., Balaguer M.D., Colprim J. (2020). **Achieving nitrification repression in an SBR at mainstream conditions through inorganic carbon limitation**, *International Biodeterioration and Biodegradation* 147, 104865.
- > Akaboci T.R.V., Gich F., Rusalleda M., Balaguer M.D., Colprim J. (2018). **Assessment of operational conditions towards mainstream partial nitrification-anammox stability at moderate to low temperature: Reactor performance and bacterial community**. *Chemical Engineering Journal* 350, 192-200.
- > Akaboci T.R.V., Gich F., Rusalleda M., Balaguer M.D., Colprim J. (2018). **Effects of extremely low bulk liquid DO on autotrophic nitrogen removal performance and NOB suppression in side- and mainstream one-stage PNA**. *Journal of Chemical Technology and Biotechnology*, 93, 2931-2941.
- > Vilà-Rovira A., Rusalleda M., Balaguer M.D., Colprim J. (2018). **Hydrodynamic simulations and biological modelling of an Anammox reactor**. *Journal of Chemical Technology and Biotechnology* 93, 1190-1197.
- > Johansson S., Rusalleda M., Colprim J. (2017). **Phosphorus recovery through biologically induced precipitation by partial nitrification-anammox granular biomass**. *Chemical Engineering Journal* 327, 881-888.