

SCIENTIFIC PORTFOLIO

Anammox-based autotrophic nitrogen removal from wastewater

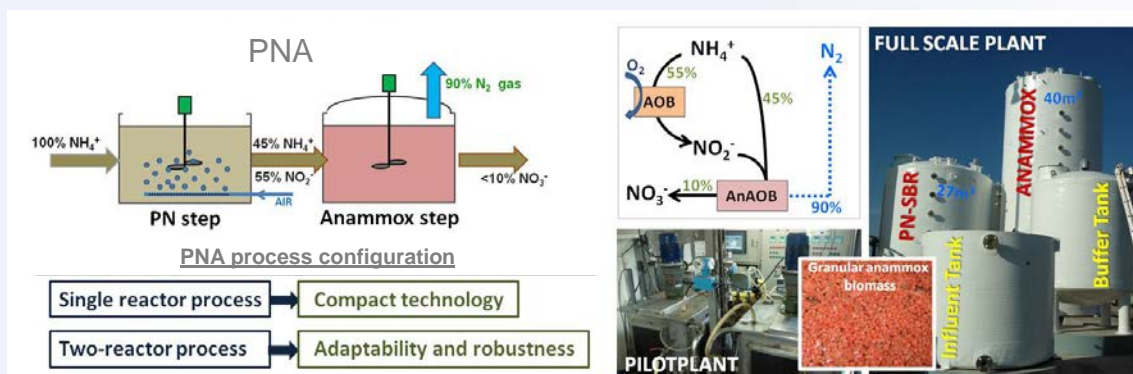
Last updated: January 2019

Name of the scientists in charge

- > **Dr Jesús Colprim**, Associate Professor. J.Colprim@lequia.udg.cat
- > **Dr Maria Dolors Balaguer**, Full Professor. marilos@lequia.udg.cat
- > **Dr Albert Magrí**, Postdoctoral researcher. albert.magri@lequia.udg.cat
- > **Dr Albert Vilà**, Postdoctoral researcher. albert.vila@lequia.udg.cat

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, organic carbon dosage avoidance, 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 (N_2O).
- > Identification of microbial populations through molecular techniques (FISH, PCR, qPCR, NGS).
- > Phosphate bio-induced precipitation together with the PNA process aiming at phosphorus recovery.

Most relevant projects

- > **DigesTake** - Recovery of resources from urban digestates within the framework of the circular economy. ACCIÓ-Generalitat de Catalunya. RIS3CAT "Comunitat Aigua". COMRD116-1-0061. 2017-2020.
- > **TreatREC** - Interdisciplinary concepts for municipal wastewater treatment and resource recovery. Tackling future challenges. European Commission. H2020 - MSCA - ITN – 2014. GA: 642904. 2015-2018.
- > **N-OPTIMOX**: First demonstration plant of the PANAMMOX® technology applied to the treatment of leachates. Spanish Ministry of Science and Innovation. INNPACTO. IPT-2011-1073-310000. 2011-2014.
- > **NIMOX**: Partial nitrification and anaerobic oxidation of ammonium by anammox biomass from anaerobic digestion effluents of urban WWTP. Spanish Ministry of Education and Science. DEX-560620-2008-149. 2008-2010.

Most relevant publications

- > Akaboci, T.R.V.; Gich, F.; Rusalleda, M.; Balaguer, M.D.; Colprim, J. (2018). **Assessment of operational conditions towards mainstream partial nitritation-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.
- > Connan, R.; Dabert, P.; Moya-Espinosa, M.; Bridoux, G.; Béline, F.; Magrí, A. (2018). **Coupling of partial nitritation and anammox in two- and one-stage systems: Process operation, N₂O emission and microbial community.** *Journal of Cleaner Production* 203, 559-573.
- > 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 nitritation-anammox granular biomass.** *Chemical Engineering Journal* 327, 881-888.
- > Rusalleda, M.; Seredynska-Sobecka, B.; Ni, B.-J.; Arvin, E.; Balaguer, M.D.; Colprim, J.; Smets, B. F. (2014). **Spectrometric characterization of the effluent dissolved organic matter from an anammox reactor shows correlation between the EEM signature and anammox growth.** *Chemosphere* 117, 271-277.
- > Gabarró, J.; González-Cárcamo, P.; Rusalleda, M.; Ganigué, R.; Gich, F.; Balaguer, M.D.; Colprim, J. (2014). **Anoxic phases are the main N₂O contributor in partial nitritation reactors treating high nitrogen loads with alternate aeration.** *Bioresource Technology* 163, 92-99.
- > Anfruns, A.; Gabarró, J.; Gonzalez-Olmos, R.; Puig, S.; Balaguer, M.D.; Colprim, J. (2013). **Coupling anammox and advanced oxidation-based technologies for mature landfill leachate treatment.** *Journal of Hazardous Materials* 258-259, 27-34.