

RESEARCH PORTFOLIO

Phosphorus precipitation and recovery from wastewater and organic liquid streams

November 2024

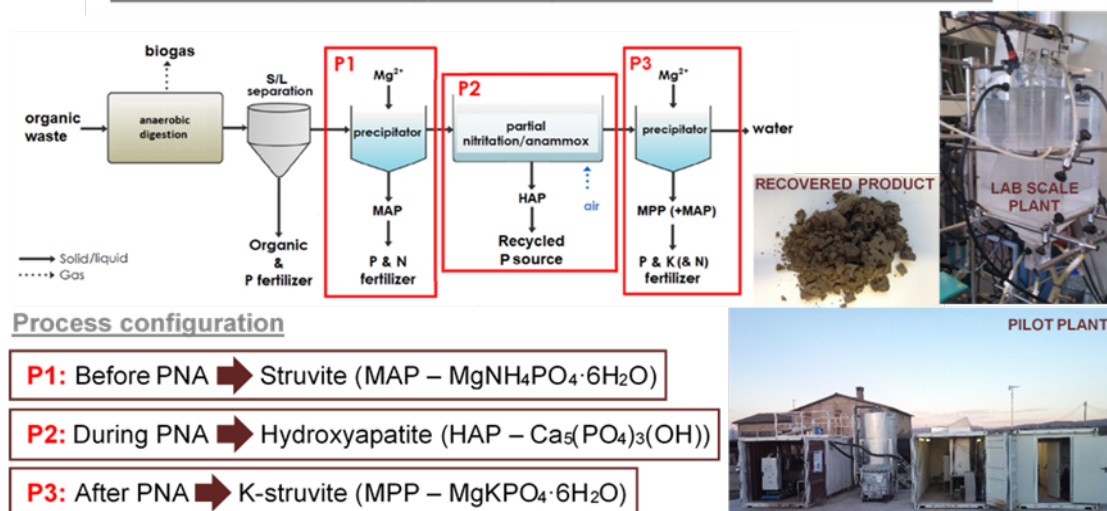
Name of scientists in charge

- > **Dr Jesús Colprim**, Full Professor – jesus.colprim@udg.edu
- > **Dr Maria Dolors Balaguer**, Full Professor – dolors.balaguer@udg.edu

Technology description

- > Phosphate crystallization, precipitation and separation from wastewater and other organic streams.
- > Production of magnesium phosphates (MAP – struvite and MPP – K-struvite) and calcium phosphates.
- > Recovery of nutrients (N-P-K) to be used as fertilizer or as raw material by the chemical industry in the framework of the circular economy, thus replacing mining resources.

Phosphorus recovery from digestate in combination to PNA



Overview of P precipitation alternatives coupled to biological N removal when treating digestate: scheme, process configuration, lab- and pilot-scale plants, and final product recovered

Research expertise

- > Inorganic P precipitation from wastewater and other liquid streams (e.g. digestate, livestock manure) as magnesium or calcium phosphates (i.e. struvite or apatite). Implementation of nutrient recovery oriented alternatives in waste(water) treatment plants.
- > Studies concerning treatment of wastewater with variable phosphate, ammonium, potassium, magnesium or calcium contents, conductivity, COD and complex matrix.
- > Expertise on process design, configuration and operation for wastewater treatment. Studies on process automation. Modelling approach. Scalability. Testing of operational conditions depending on the characteristics of the waste water to be treated.
- > Use of advanced analytical and microscopy techniques to characterize composition and crystal growth in recovered products (XRD, ICP-MS, ICP-OES, SEM-EDX).

- > Expertise on conditioning pretreatments aiming to decrease the phosphate content in the water line. Know-how on controlling particle size during crystallization. Testing of alternative magnesium sources to promote struvite precipitation.
- > Phosphate bio-induced precipitation together with autotrophic N-removal based on anaerobic ammonium oxidation (anammox).
- > Expertise on refining post-treatments, taking advantage of the lower availability of alkalinity facilitating pH-control (less consumption of reagents) or ammonium ion allowing for K-struvite recovery.

Projects

- > **SPORE-MED** – Sustainable upgraded WWTPs for resource recovery, water reuse and health surveillance in the Mediterranean region. PRIMA-Section1-Call 2023-Topic 1.1.1. GA: 2322. 2024-2027. www.spore-med.eu
- > **K-EcoFeRtilizer** - Development of a new process for the recovery of potassium struvite usable as fertiliser applied to the treatment of pig slurry. Granges Terragrisa S.L. DARP, Projectes Pilots de Grups Operatius 2019. 56.21.024.2019 5C. 2020-2022.
- > **DigesTake** - Recovery of resources from urban digestates within the framework of the circular economy. ACCIÓ-Generalitat de Catalunya. RIS3CAT Comunitat Aigua. COMRDI16-1-0061. 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.

Publications

- > Dessi, E., Company, E., Pous, N., Milia, S., Colprim, J., Magrí, A. (2024), **Reagent-free phosphorus precipitation from a denitrified swine effluent in a batch electrochemical system**, *Heliyon*, 10, 17, 2024, e36766.
- > Mendoza, E., Magrí, A., Blandin, G., Bayo, A., Vosse, J., Buttiglieri, G., Colprim, J. and Comas, J. (2023), **Second-Generation Magnesium Phosphates as Water Extractant Agents in Forward Osmosis and Subsequent Use in Hydroponics**, *Membranes*, 13(2), 226.
- > Company, E.; Farrés, M.; Colprim, J.; Magrí, A. (2022). **Exploring the recovery of potassium-rich struvite after a nitrification-denitrification process in pig slurry treatment**. *Science of the Total Environment*. 84715, 157574.
- > 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.
- > Magrí A., Carreras-Sempere M., Biel C., Colprim J. (2020). **Recovery of phosphorus from waste water profiting from biological nitrogen treatment: Upstream, concomitant or downstream precipitation alternatives**. *Agronomy* 10(7), 1039.
- > Johansson S., Rusalleda M., Saerens B., Colprim J. (2018). **Potassium recovery from centrate: taking advantage of autotrophic nitrogen removal for multi-nutrient recovery**. *Journal of Chemical Technology and Biotechnology* 94(3), 819-828.
- > Tarragó E., Sciarria T.P., Rusalleda M., Colprim J., Balaguer M.D., Adani F. Puig, S. (2018). **Effect of suspended solids and its role on struvite formation from digested manure**. *Journal of Chemical Technology and Biotechnology* 93(9), 2758-2765.
- > 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.