

## SCIENTIFIC PORTFOLIO

Phosphorus precipitation and recovery from wastewater and organic streams

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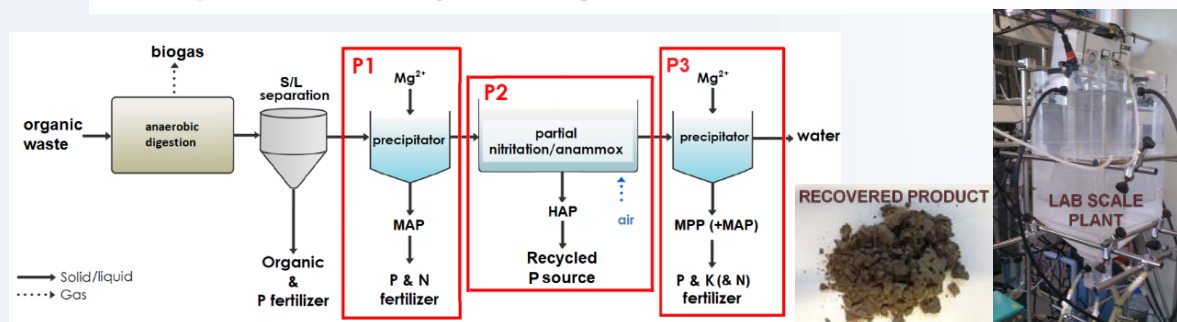
### Name of the scientists in charge

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### 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



#### Process configuration

**P1:** Before PNA ➔ Struvite (MAP –  $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$ )

**P2:** During PNA ➔ Hydroxyapatite (HAP –  $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$ )

**P3:** After PNA ➔ K-struvite (MPP –  $\text{MgKPO}_4 \cdot 6\text{H}_2\text{O}$ )



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 waste water 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. Decrease of the conductivity of the water line.

## Most relevant projects

- > **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.
- > **ManureEcoMine** - Green fertilizer upcycling from manure: Technological, economic and environmental sustainability demonstration. FP7-ENV: GA 603744. 2013-2016.

## Most relevant publications

- > Johansson, S.; Rusalleda, M.; Saerens, B.; Colprim, J. **Potassium recovery from centrate: taking advantage of autotrophic nitrogen removal for multi-nutrient recovery.** *Journal of Chemical Technology and Biotechnology* (in press).
- > 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, 2758-2765.
- > 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.
- > Pintucci, C.; Carballa, M.; Varga, S.; Sarli, J.; Peng, L.; Bousek, J.; Pedizzi, C.; Rusalleda, M.; Tarragó, E.; Prat, D.; Colica, G.; Picavet, M.; Colsen, J.; Benito, O.; Balaguer, M.; Puig, S.; Lema, J.M.; Colprim, J.; Fuchs, W.; Vlaeminck, S.E. (2017). **The ManureEcoMine pilot installation: advanced integration of technologies for the management of organics and nutrients in livestock waste.** *Water Science and Technology* 75, 1281-1293.
- > Tarragó, E.; Puig, S.; Rusalleda, M.; Balaguer, M.D.; Colprim, J. (2016). **Controlling struvite particles' size using the up-flow velocity.** *Chemical Engineering Journal* 302, 819-827.