European Sustainable Phosphorus Platform

This project has received funding from the EU Horizon 2020 research and innovation programme under grant agreement No. 690323

SMART-Plant

ECOMONDO
THE GREEN TECHNOLOGIES EXPO
22ª Fiera internazionale del recupero di materia ed energia e dello sviluppo sostenibile

Green & Circular Economy
6-9 Novembre 2018
Rimini Italy
IN CONTEMPORANEA CON
KEY ENERGY

Phos4You – PhosForce
Upgrading Phosphorus Recovery

Marisa Cunha, Cédric Mebarki – VEOLIA

3rd EUROPEAN NUTRIENT EVENT @ ECOMONDO 2018

8 - 9 November 2018, Rimini, Italy

www.smart-plant.eu/ENE3

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Objective: 20 – 25 % recovery → > 50 % recovery

Various pilot projects:

Scotland, part of the Phos4You project.
In partnership with the ERI, Scotland.

Interreg North-West Europe Phos4You

Lille, France, part of the Phos4You project.
In partnership with the IRSTEA, France.

Schönebeck, Germany – PhosForce project.
Consortium:
- Veolia
- MEERI, Poland
- UNL, Portugal

Funding eit RawMaterials

Interreg
North-West Europe
Phos4You
European Regional Development Fund

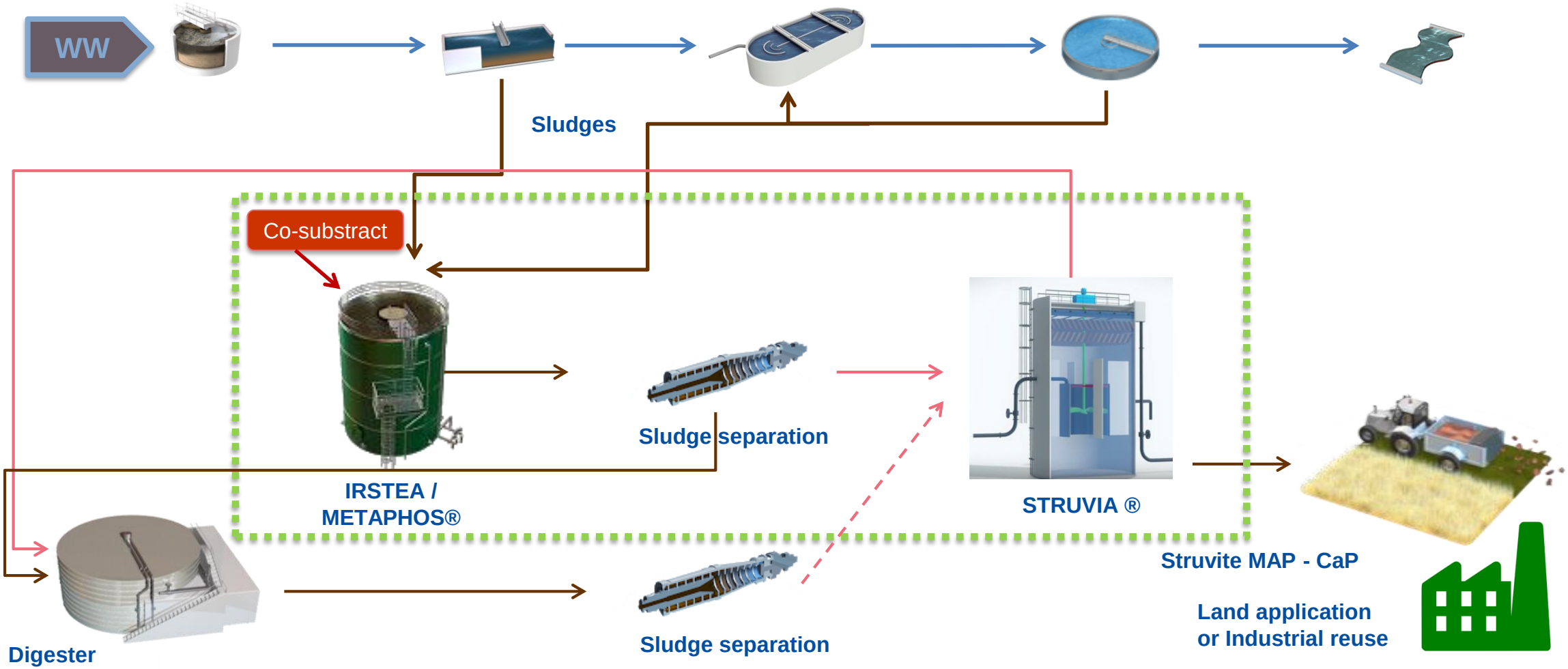
We deliver Phosphorus "made in Europe"

RESSOURCEN- UND MATERIALEFFIZIENZ

Phosphorus is a nutrient essential for all living organisms, but a finite resource on earth. Phos4You proves that Phosphorus recovery & recycling from waste water is possible.

from Sept. 2016 to Sept. 2020

Schematic of the plant



Struvia pilot trials – Initial test at Lille in 2016

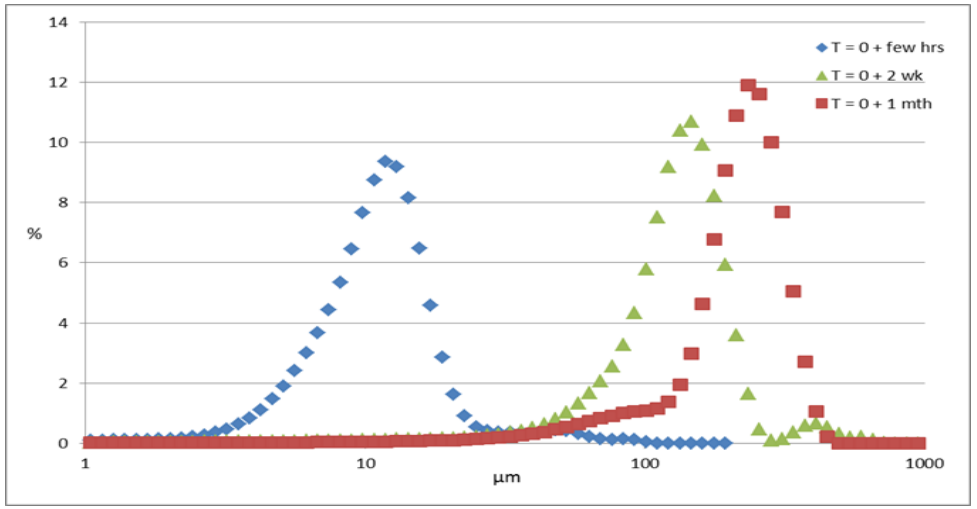
pH (pH units)	Sol. P-PO_4 (mg/l)	Sol. N-NH_4 (mg/l)	Sol. Mg (mg/l)	TSS (g/l)	tCOD (g/l)	Sol. Ca (mg/l)	P-PO_4 Removal (%)
Brussels: Effluent from Athos (Wet Air Oxidation process)							
8 – 9	200 - 250	3000 - 4000	<10	0.2 – 1	7 - 15	<10	> 80
Brussels: Mixture Athos + centrate of thickened sludge							
7.5 – 8.5	80 - 180	100 - 1000	<50	0.2 – 2.5	2 - 6	80 – 150	> 85, often > 90
Braunschweig: centrate from digested sludge							
8.1 – 8.5	340 - 420	1200 – 1400	<2 - 3	0.05 – 0.25	0.5 – 0.9	20 - 25	> 90, often > 95
Lille- Marquette: Mixture 1st + 2nd digestion centrates (DLD with Exelys thermohydrolysis process) – done with a lab pilot unit							
8.2 – 8.6	**95 - 155**	750 - 1200	< 9	1 - 2	2 - 3	20 - 55	80 - 90
Dairy in Poland: Filtrate from digested sludge							
7.8 – 8.2	50 - 70	~1000	7 - 50	40 - 200		40 - 80	70 - 95

Quality of the struvite produced by STRUVIA®

- Total P=12.5-13 %wDS (app. 28-29%w de P_2O_5)
- Total N=5-5.5 %w
- Mg = 9.5-10.5%w
- Organic Carbon < 1 %w
- Ca = 0.5-2 g/kg
- K = 1-1.5 g/kg
- SiO_2 = around 2 g/kg
- SO_4 = 300-400 mg/kg
- Fe = 300-500 mg/kg
- Al = 50-100 mg/kg
- Mn = 30-40 mg/kg
- Zn = 30-40 mg/kg
- Cu = around 3 mg/kg
- Cr = around 2 mg/kg
- Cd, Ni, Pb < 2 mg/kg
- Sn < 2 mg/kg
- Se < 0.5 mg/kg
- As < 0.5 mg/kg
- Hg < 0.1 mg/kg

Granulometry: 200 to 500 µm in steady state operation conditions

Pure struvite composition:
- N/P/Mg = 5.7/12.6/9.9
- (29 % P2O5)

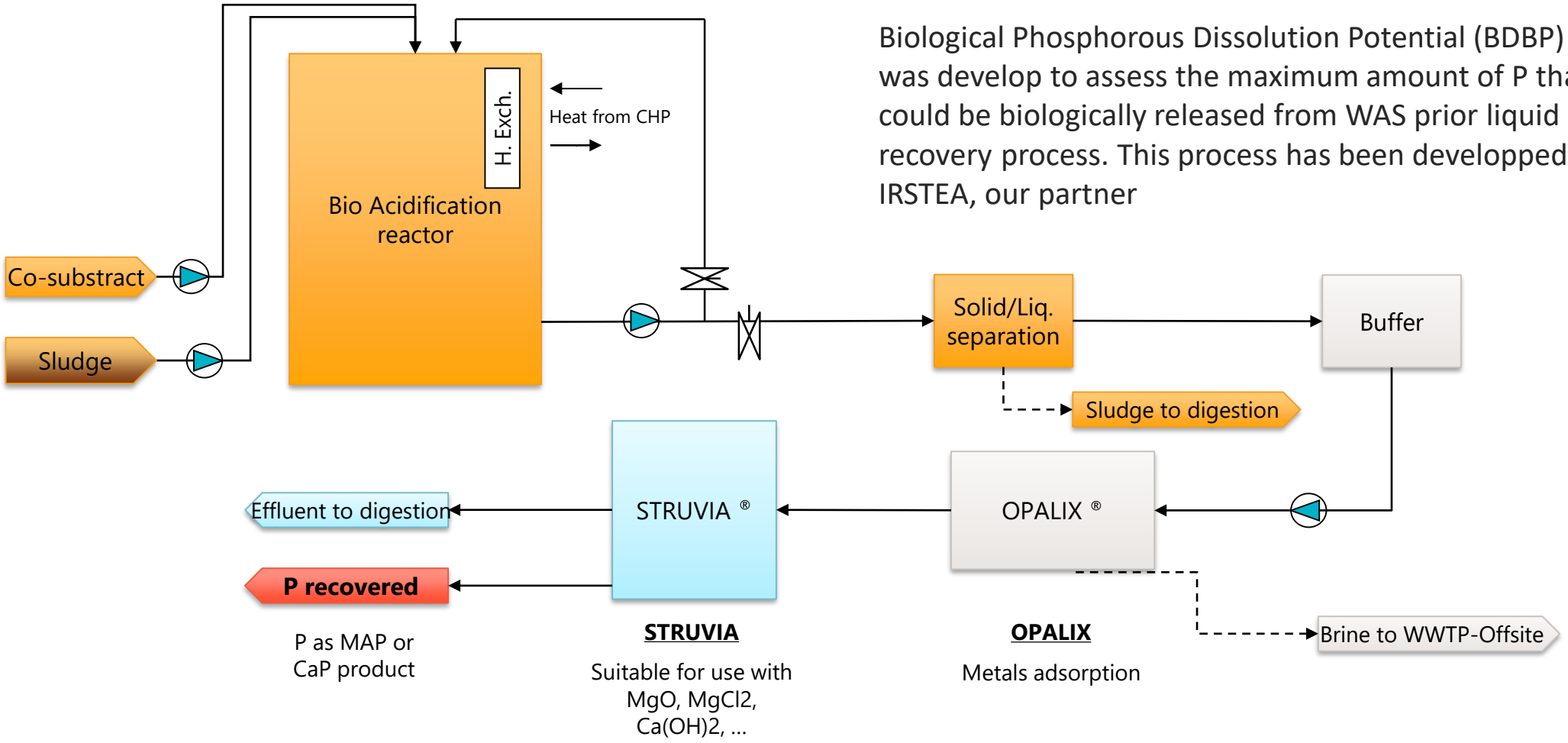


STRUVIA plant at Helsingør, Denmark

Drained struvite crystals Fertilizer granules including STRUVIA granules

Fertilizer granules including STRUVIA crystals

Pilot schematic: IRSTEA-VEOLIA processes



Biological Phosphorous Dissolution Potential (BDBP) test was develop to assess the maximum amount of P that could be biologically released from WAS prior liquid recovery process. This process has been developped by IRSTEA, our partner

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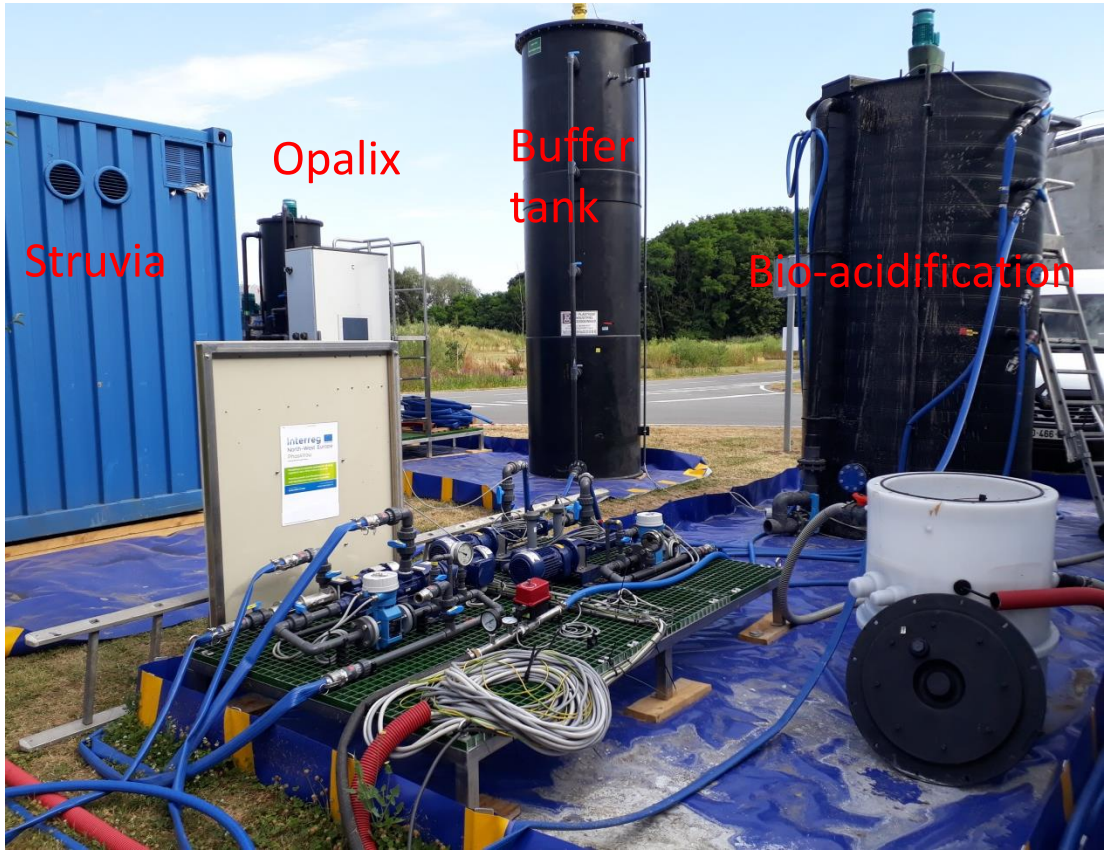
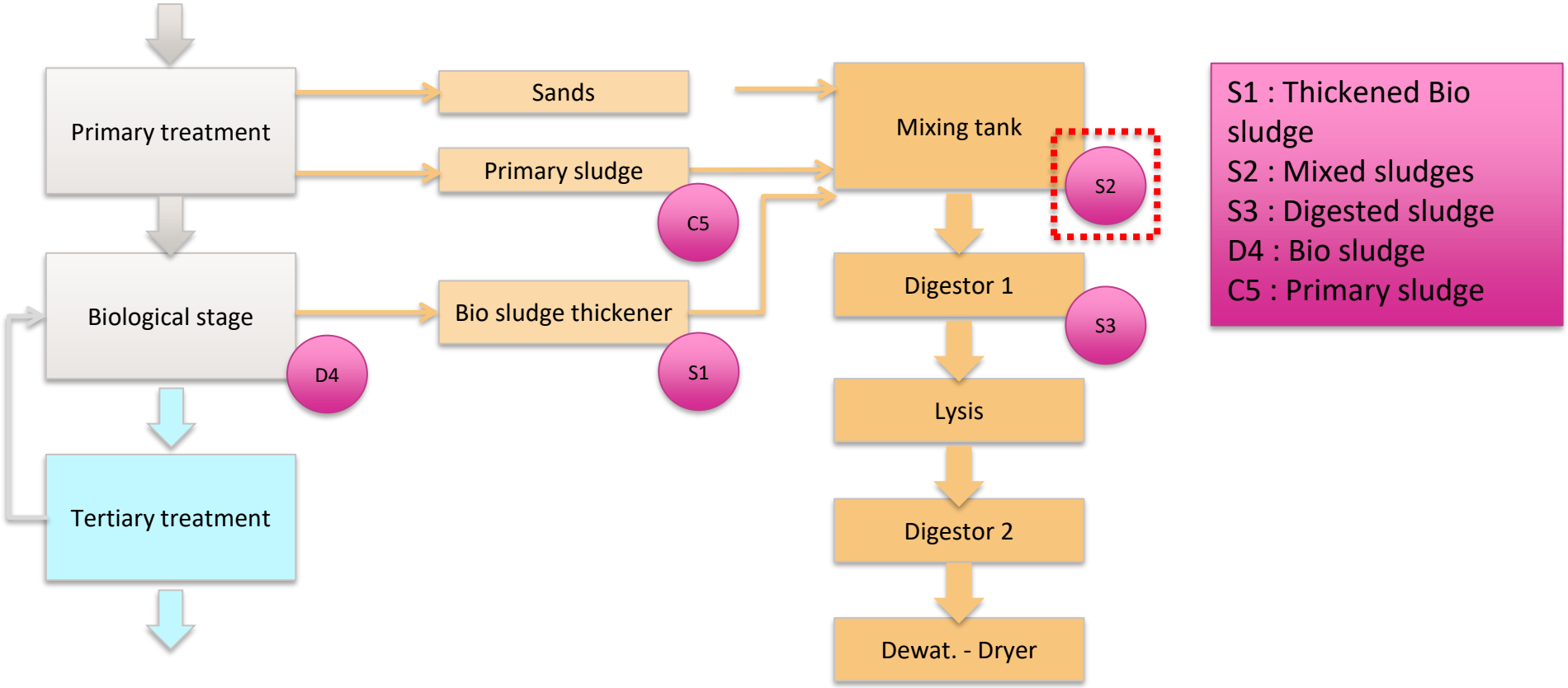
Pilot implementation



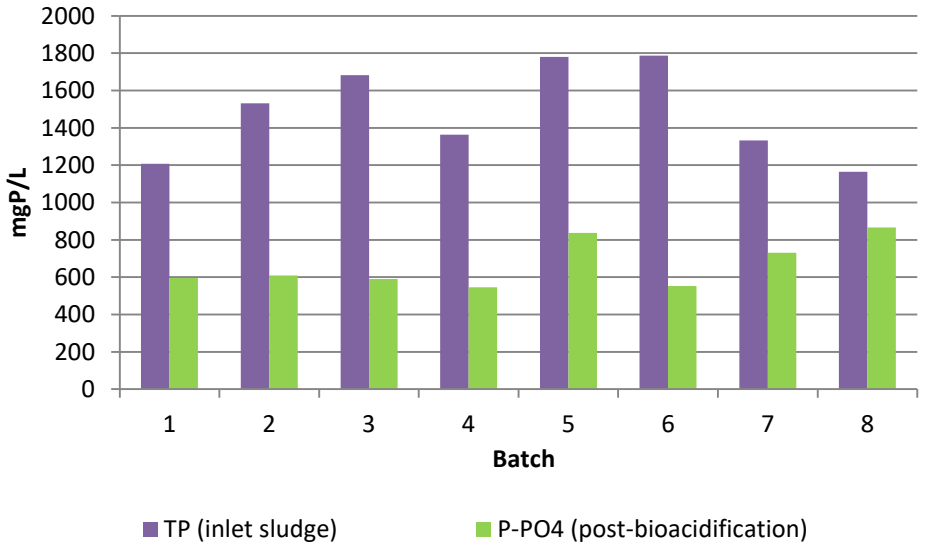
Sludges selection

Sludge samples have been collected at Lille-Marquette plant, at different treatment stages:



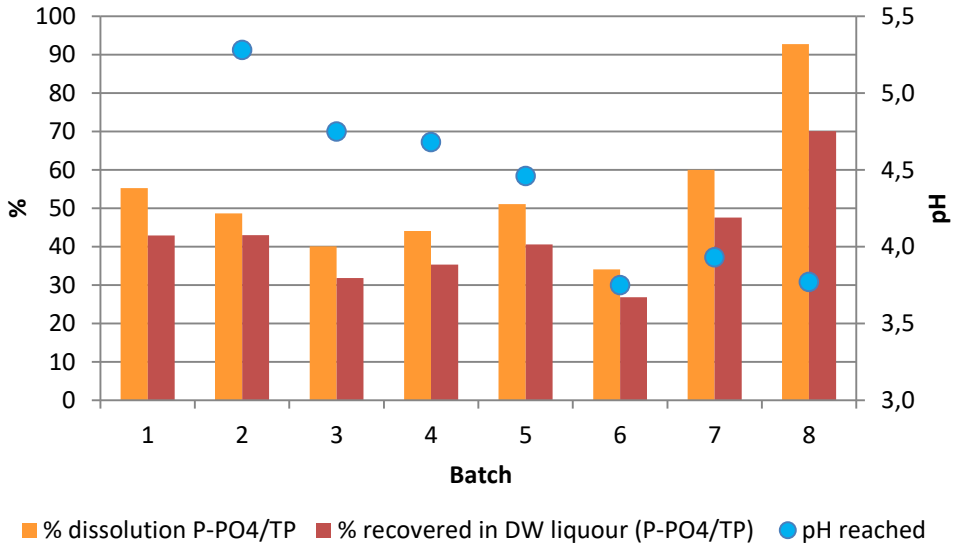
First results

Total phosphorus in inlet sludge and ortho-phosphate released



Fluctuations in inlet sludge quality due to the heterogeneity of the mix (primary, bio, storm water sludges). Feed pH between 5.5 and 6

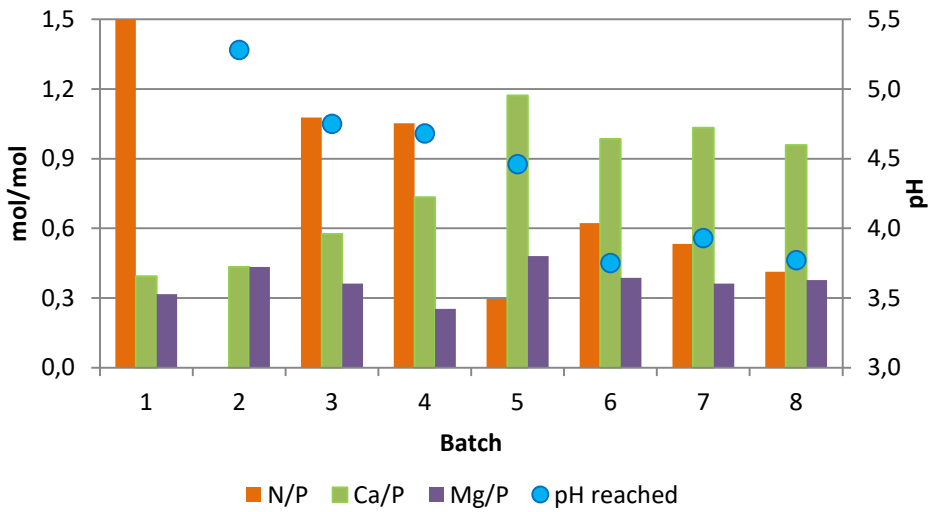
% P-PO4 solubilised and recovered after bio-acidification and dewatering



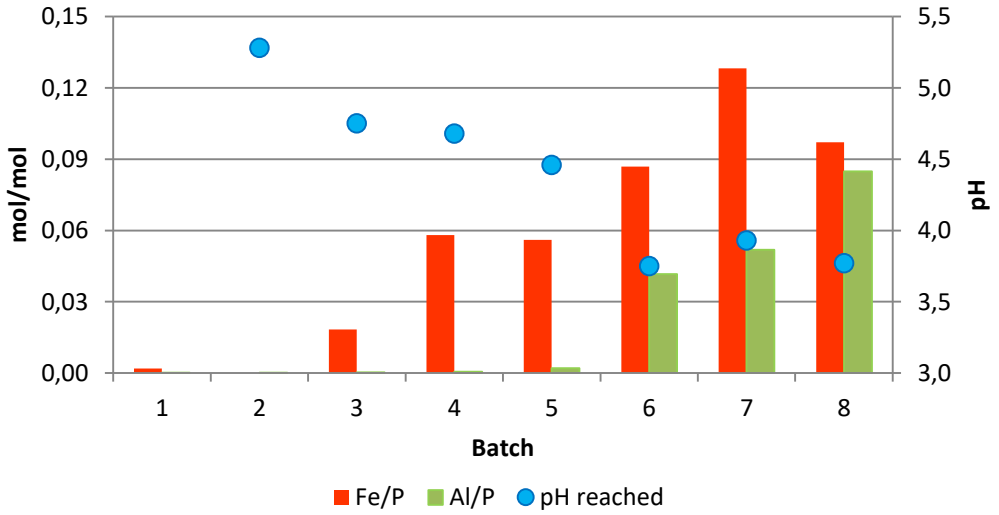
Up to 800 mg/l, > 70% dissolution and recovery of P-PO_4 on best batch.
~6 x current [P-PO_4] post-digestion

First results

Molar ratios of relevant elements after bio-acidification.



Recovered P product will probably be calcium phosphate or a mix of CaP and MAP-struvite.



Low Fe/P and Al/P molar ratios (<0.15 mol/mol). Low probability of having major complexation of PO_4 by those elements.

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Italian Phosphorus Platform

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GRUPPO HERA

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Tests to be continued

and results to be improved upon.

Thank you for your attention.

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www.veolia.com