Workshop: P-recovery as struvite. Regulation constraints for its use as fertilizer

PHORWater

Integral Management Model for Phosphorus recovery and reuse from Urban Wastewater

LIFE12 ENV/ES/000441

Lyon-Villeurbane, 12th May 2016
Phosphorus concerns

Three most pressing issues associated with P as a global resource have been identified:

- resource scarcity
- global food security
- environmental impacts

Sustainable strategies

1. Reducing mining losses.
2. Efficiency in agriculture.
3. Recovery.
Phosphorus at WWTP

Discharges of phosphorus through WWTP have to be limited.

P arrives with N and other nutrients

EBPR allows P-recovery.

Anaerobic digestion of EBPR sludge releases P-rich streams.

Uncontrolled precipitation.

P to sludge

P to water bodies
Phosphorus at WWTP

Pipe blockage

Equipment damage
Consortium DAM, CALAGUA, and LAGEP

PHORWater LIFE project (2013-2016):

“Integral Management Model for Phosphorus Recovery and reuse from Urban Wastewater”

Sustainable Management of P in WWTPs

Uncontrolled P precipitation
P recovery from sludge line supernatants
LIFE+ PHORWater (Sept 2013 – Sept 2016)

“Integral Management Model for Phosphorus Recovery and Reuse from Urban Wastewater”

The main objective of PHORWater is to demonstrate, at pre-industrial scale, the viability and sustainability of the correct management of the P in a WWTP obtaining struvite by crystallization.
What make PHORWater different

PHORWater moves from less to more at three different levels

- **PHORWater struvite precipitation**
  - Simple and easy control reactor
  - Low P at effluent
  - P recovered as struvite
  - Less P at sludge

- **PHORWater sludge line configuration**
  - Less uncontrolled precipitation
  - More P availability

- **EBPR**
  - P removal
  - Less reagent
  - Less sludge volume
Consortium DAM, CALAGUA, and LAGEP

PHORWater LIFE project:

“Integral Management Model for Phosphorus Recovery and reuse from Urban Wastewater”
Consortium DAM, CALAGUA, and LAGEP

PHORWater LIFE project:
“Integral Management Model for Phosphorus Recovery and reuse from Urban Wastewater”
Consortium DAM, CALAGUA, and LAGEP

PHORWater LIFE project:

“Inegral Management Model for Phosphorus Recovery and reuse from Urban Wastewater”
Project location

El Cidacos WWTP, Calahorra, Spain
Project location

23,000 m³/day
EBPR (A2O Configuration)

Anaerobic digestion for primary and secondary sludge
El Cidacos WWTP

Primary Settling

Primary Sludge Thickening

11 m diameter
3.5 m height

SIDESTREAM RETURNS

SIFER Rotary Screw Thickener
7-8% SS

Secondary Settling

Mixing Chamber

V = 494 m³
Uncontrolled precipitation observed

V = 1.930 m³
RT = 20 d
SCABA agitator

Secondary Anaerobic Digestion

Anaerobic Digestion

Sludge Dewatering

SIDESTREAM RETURNS

DAM
Universitat de València
Cal Agua
Université Claude Bernard Lyon 1
LAGEP
# Project structure

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| **B. Implementation actions** | B.1 Integral management of the WWTP for optimal phosphorus recovery.  
B.2 Design, construction and start-up of the crystallization process.  
B.3 Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.  
B.4 Validation of the obtained struvite as a fertiliser.  
B.5 Economical feasibility study. |
| **C. Monitoring of the impact of the project actions** | C.1 Effectiveness of the project actions. Project results monitoring.  
C.2 Project socioeconomical impact. |
| **D. Communication and dissemination actions** | D.1 Communication and dissemination of project results. |
| **E. Project management and monitoring of the project progress** | E.1 Project management.  
E.2 Networking activities.  
E.3 After LIFE Communication Plan |
Project structure

B. Implementation actions

- B.1 Integral management of the WWTP for optimal phosphorus recovery.
- B.2 Design, construction and start-up of the crystallization process.
- B.3 Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.
- B.4 Validation of the obtained struvite as a fertiliser.
- B.5 Economical feasibility study.

Performed to determine the type and extent of phosphate fixation throughout the plant and to enhanced the phosphorus recovery

Tasks:

- Characterisation of the water and sludge lines of the WWTP
- Mass balances performance
- Identification of the optimal WWTP operational configuration in order to minimize uncontrolled phosphorus and enhance phosphorus recovery
- Implementation of the optimal operational configuration
- Validation of the new WWTP configuration (correct functioning checking)
### Project structure

**B. Implementation actions**

- **B.1** Integral management of the WWTP for optimal phosphorus recovery.
- **B.2** Design, construction and start-up of the crystallization process.
- **B.3** Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.
- **B.4** Validation of the obtained struvite as a fertiliser.
- **B.5** Economical feasibility study.

---

**Construction of a struvite crystallizer and its implementation at the WWTP**

**Tasks:**

- Crystallizer and auxiliary elements design
- Control algorithm design and development
- Suppliers search and offers requests
- Phosphorus recovery plant construction and installation
- Validation of the installation (correct functioning checking)
### Project structure

#### B. Implementation actions

- **B.1 Integral management of the WWTP for optimal phosphorus recovery.**
- **B.2 Design, construction and start-up of the crystallization process.**
- **B.3 Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.**
- **B.4 Validation of the obtained struvite as a fertiliser.**
- **B.5 Economical feasibility study.**

**Implementation, control and continuous operation of the process proposed**

**Tasks:**

- Start up and continuous operation of the P recovery plant
- Training session for operators of the plant
- Analyses of the involved streams for a correct monitoring of the P recovery process
- Data registration, acquisition and processing
- Biological P removal process control
- Sludge line P recovery process control
## Project structure

### B. Implementation actions

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.1</td>
<td>Integral management of the WWTP for optimal phosphorus recovery.</td>
</tr>
<tr>
<td>B.2</td>
<td>Design, construction and start-up of the crystallization process.</td>
</tr>
<tr>
<td>B.3</td>
<td>Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.</td>
</tr>
<tr>
<td>B.4</td>
<td>Validation of the obtained struvite as a fertiliser.</td>
</tr>
<tr>
<td>B.5</td>
<td>Economical feasibility study.</td>
</tr>
</tbody>
</table>

*Morphological and agronomical aspects of the struvite produced are evaluated in this action*

**Tasks:**
- Recovered struvite characterization
- Struvite agriculture application assays
Project structure

<table>
<thead>
<tr>
<th>B. Implementation actions</th>
<th>B.1 Integral management of the WWTP for optimal phosphorus recovery.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B.2 Desing, contruction and start-up of the crystallization process.</td>
</tr>
<tr>
<td></td>
<td>B.3 Implementation on the Phosphorus recovery demonstration pilot plant. Struvite production.</td>
</tr>
<tr>
<td></td>
<td>B.4 Validation of the obtained struvite as a fertiliser.</td>
</tr>
<tr>
<td></td>
<td>B.5 Economical feasibility study.</td>
</tr>
</tbody>
</table>

The objective of this action is to study the real feasibility of implementing the process proposed in the project.

**Tasks:**
- A market study aimed to know potential users of the recovered P and their localization
- A study focused on analysing the economic feasibility of the process
THANK YOU FOR YOUR ATTENTION

laura.pastor@dam-aguas.es
www.phorwater.eu
www.dam-aguas.es
www.aguas-residuales.es
www-lagep.cpe.fr