



Newsletter

01/10/15

GREETINGS

Circular Economy is getting a very familiar concept. Our society is aware of limited resources and scarcity problems so we are moving towards new technologies that allow recover a reuse valuable resources. PHORWater is an example that allows recover phosphorus from wastewater, avoiding discharges recovering a valuable product that can be used at agriculture as fertilizer, struvite.

Along these months the struvite recovery crystallization reactor has been designed and implemented at Calahorra WWTP, and we are producing some crystals, but we have to be sure that those crystals are good quality struvite, analysing its purity and its value as fertilizer.

With this objective in mind, validation of struvite as fertilizer action has been launched. We will perform a complete characterization of the product and also field application tests will be assessed to compare its effectiveness with other commercial fertilizers and we will share the results at the end of the project.

Hoping keep your interest on our project evolution.

Sincerely

Laura Pastor Alcañiz
PHORWater Project Manager
Depuración de Aguas del Mediterráneo

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IMPLEMENTATION AND START-UP OF THE CRYSTALLIZATION REACTOR

After 21 months of project, on May 12th, 2015 the crystallization reactor was implemented and started-up for phosphorus recovery as struvite at Calahorra WWTP, with capacity to treat up to 20 m³ / d of supernatant from the gravity thickener, representing 20% of the supernatant that is generated in the wastewater treatment plant.

Startup consisted of beginning to feed continuously the reactor with the supernatant from the gravity thickener, placing the reagent inlet and agitator height as it was calculated at the fluid dynamics simulations and controlling reagents dosing by means of the developed control system.

This allowed adjusting the pH inside the reactor and magnesium dosage depending on the influent characteristics, ensuring complete mixing in the reaction zone and leading to the formation of struvite crystals of good quality.

During this operation period, the

operational parameters set in the crystallisation plant were the following ones:

- pH: 8.7
- Mg/P molar ratio: 1:6
- HRT: 9.8 h (4 h at the reaction zone)
- stirring speed: 55 rpm
- magnesium concentration at the MgCl₂ solution: 4800 mg Mg/l
- concentration of the NaOH solution: 0.6 M

During this initial period, considering until stationary state was reached, reactor was fed with 12.5 m³/d of supernatant with a concentration of 92 mg P-PO₄/l. Precipitation efficiency under this conditions reached about 85-90%, producing 6 kg/d of struvite.

Crystallization reactor was fed from the bottom in a continuous mode, while solids were removed in a batch-wise,



Picture 1: Crystallization reactor

VALIDATION OF THE OBTAINED STRUVITE.

Since July 9th 2015 the crystallization reactor installed in the sewage treatment plant has been operating Calahorra continuously, producing struvite 7.8 kg / d.

The crystals obtained during this time have been analysed to determine its size and composition to ensure product quality crystallization and its value as a fertilizer.

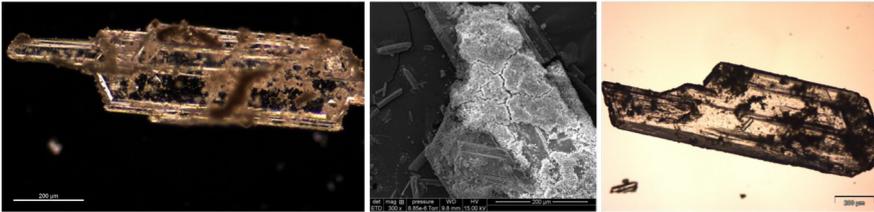
Total Organic Carbon (TOC), representing less than 0.9%.

Regarding heavy metals content, result reveal a very low content in all of them observed, including a very low content of cadmium. This metal is present in commercial fertilizers made from the phosphate rock from Morocco,

The analysis also shows very low levels of organic compounds, suggesting that it will be a safe product for use in agriculture.

To assess its value as a fertilizer, agricultural application trials are going to start on crops of potato and wheat, in which the performance of three different plots, a first in which only struvite from the WWTP is applied will be compared, a second in which the struvite from the WWTP with other fertilizers that provide the nutrients lacking struvite, mainly potassium, and finally to the last plot will apply commercial fertilizers will be combined.

After the harvest, we will proceed to analyse both plants and the harvested product to ensure the safety of our fertilizer.



Picture 2: Struvite crystals

Both, optical and electronic microscopy (SEM-EDAX) show struvite as the main product of the recovered product, with a composition of 11.8% P, 6.0% N and 9.5% Mg, 81% purity in MAP and a particle size greater than 200 microns, making it a suitable product for handling.

The low organic matter content was evaluated by determining the



Picture 3: Struvite obtained at Calahorra WWTP

PROJECT ADVANCE & COMMING DUTIES

Action 1. Integral management of the WWTP for optimal phosphorus recovery. This task finished on March 2015

Action 2. Design, construction and start-up of the phosphorus crystallization process. This task finished on May 2015.

Action 3. Implementation on the phosphorus recovery at the pilot plant and struvite production. This task began on April 2015, and includes the following tasks::

- Start up and continuous operation of the phosphorus recovery plant.
- Training session for operators of the plant.
- Analyses of the involved streams for a correct monitoring of the

phosphorus recovery process.

- Data registration, acquisition and processing.
- Biological phosphorus removal process control.
- Sludge line and phosphorus recovery process control.
- Exploitation y maintenance of the plant.

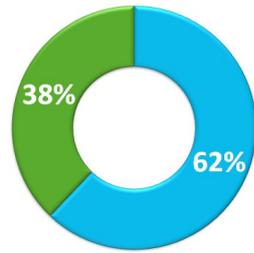
Action 4. Validation of obtained struvite as fertilizer. This task began with the analysis of the lab-scale struvite and it continues now with the characterisation of the estruvite obtained at the WWTP, and includes the following tasks:

- Struvite characterisation.
- Struvite agricultural application assays.

CURRENT STATE

The following graph shows the evolution of the project from its

beginning to its full implementation.



■ Executed ■ Remaining

Picture 4: Project's evolution graph

NEWS

PHORWater joins the IWA Nutrient Removal and Recovery 2015 Conference: moving innovation into practice

PHORWater Project, framed within the LIFE+ programme with the contribution of the European Commission, has developed an integral model to enhance phosphorus removal at WWTP and a novel technology for its recovery as struvite.

PHORWater, a consortium coordinated by DAM (Depuración de Aguas del Mediterráneo) with the collaboration of Calagua researching group from University of Valencia and LAGEP laboratory from Claude Bernard University of Lyon, increases awareness about the environmental problems of phosphorus scarcity and eutrophication of waters and the need to develop a Phosphorus Circular Economy reducing the dependence on natural sources and giving a way to recover and reuse valuable products. In this sense PHORWater studies the global management of WWTP developing a novel technology to recover phosphorus from wastewater as struvite.

The long series of IWA specialized conferences on the nutrient removal and recovery started in Kraków in 2005 and have been a good opportunity to debate the developing technical and practical solutions on this item.

This year the conference returned to Poland with the motto “moving innovation into practice” emphasizing practical aspects of nutrient removal developments

and perspectives on their application and PHORWater project showed the so far results.

Phosphorus arrives at WWTP through influent water and has to be removed to avoid eutrophication and in this way PHORWater has developed an integral model to enhance phosphorus removal at WWTP and a novel technology for its recovery as struvite, a valuable product as slow release fertilizer to be used either directly on farming or in the fertilizers manufacture industry. The project which is being implemented at Calahorra WWTP (La Rioja, Spain), began with the upgrade of the WWTP to maximize phosphorus removal at the water line and its recovery from the sidestreams as a valuable fertilizer.

Alberto Bouzas, from UV, as responsible of some technical actions of the project, gave an overview about the work done and the obtained results, pointing anaerobic digestion as the main phosphorus lose point in the wastewater treatment process and the previous steps as the optimal point to enhance phosphorus recovery.

DAM, as a coordinator of the project was also present at the conference, where many specialist from all around the world share new solutions to bring innovation to be used in our water systems.



Picture 5: Alberto Bouzas speech at IWA-NRR15

NEWS

New blog about phosphorus recovery and its use as fertilizer

PHORWater project, framed within the LIFE+ programme with the contribution of the European Commission as supporter, has developed a forum inside the website to discuss about phosphorus recovery and its use as fertilizer.

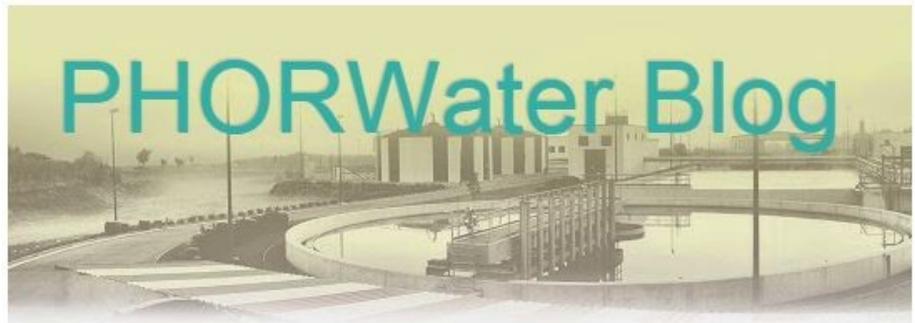
The European project that is being developed in Calahorra WWTP began in 2013 with the study of streams in order to select the best configuration of the WWTP that enhances the biological phosphorus removal process. Then crystallization reactor was designed to treat the flows from the WWTP and produce struvite and finally product quality and viability studies for agricultural application will be assessed. The main objective is offering, from the soles of wastewater treatment, a new technology that helps reducing foreign demand of phosphorus favouring the development of a circular economy

while processes in the own WWTP are optimized.

Since the project generates benefits in several sectors such as environmental, wastewater treatment, fertilizer industry and agricultural sector, project management coordination has considered essential the development of a space to transfer goals and results of the project, providing at the same time a space to express their interests and concerns in order to establish a fluid communication promoting worthy networking.

Through the website <http://phorwater.eu> you will find a direct link to access the blog.

If you would like to keep abreast of the developments in the project you can also subscribe to our biannual PW Newsletter and receive each number in your email.



Welcome to PHORWater blog, an open site to discuss about phosphorus recovery at WWTP and use of struvite as fertilizer.

Picture 6: Blog PHORWater

NEWS

PHORWater joins a workshop about needed data on nutrients to support stewardship and promote circular economy

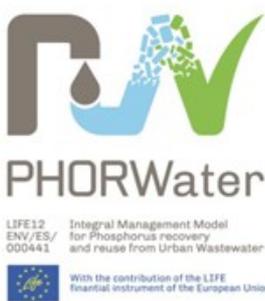
DAM as coordinator of LIFE PHORWater project, joined DONUTSS workshop, a working session with support of the EU (DG GROW), to identify what data is needed on nutrients stocks and flows by industry and agriculture sectors and decision makers, to support stewardship decisions, circular economy and management actions, and how this data should be monitored.

LIFE PHORWater, supported by LIFE+ funding from the European Commission, works on the implementation of a phosphorus recovery plant at Calahorra WWTP (La Rioja, Spain) in order to de appraised as a fertilizer the phosphorus that arrives at this WWTP and reduce phosphorus discharges into the environment.

During the development of the project a lack of available data to evaluate the amount of phosphorus that can be recovered at WWTPs in Spain and Europe has been identify and PHORWater consortium has the sense that if it is not possible to identify the

amount of phosphorus that can be recovered, it cannot be evaluated all the benefits that may be achieved, from reducing external dependency on the countries that produce phosphorus to protection of our environment.

Phosphorus arrives at WWTPs from urban discharges because phosphorus is an essential nutrient that can be found at food, but it is also found at other industrial products that end up at the sewer. Once at WWTP most of the P is removed from wastewater to the sludge so it is at the sludge treatment line where it can be recovered and appraise as fertilizer Phosphorus removal at WWTPs can take place either chemically or biologically and its value as fertilizer depends on the way that it has been removed, so it is essential to know not only the total amount of phosphorus arriving at WWTPs but also the amount of phosphorus available to be recovered at WWTPs in order to promote phosphorus circular economy.



Picture 7: Workshop Data On NUtrients To Support Stewardship

NEWS

PHORWater collaborates with REFERTIL at the Advance Compost and Biochar Processing: Solution for Economical Phosphorus Recovery Conference

Last 17-18th September REFERTIL FP7 European project organized the final conference about economical solution for phosphorus recovery at Toledo, Spain. The conference was addressed to biochar and compost processes but other solutions about phosphorus recovery like LIFE+ PHORWater were also presented.

Sofia Grau, from Depuración de Aguas del Mediterráneo-DAM, as member of PHORWater team, focused her presentation on the rising concern about phosphorus recovery and how PHORWater takes place by developing an innovative solution for wastewater treatment plants through an integral management of the flows

and the development of an struvite crystallizer. The difference between PHORWater and other phosphorus recovery systems at WWTPs was also emphasized reminding that the LIFE+ project began with an integral characterization of all the flows and the simulation of several configurations in order to maximize the amount of phosphorus available for the crystallization reactor while other techniques just install the crystallizer at the actual configuration, without avoiding operational problems.

More information about the conference can be found at the [abstract book](#).



Ilustración 8: PHORWater at REFERTIL International Conference

AGENDA

EFIAQUA

October 20- 22nd , 2015
Valencia, Spain

EFIAQUA is a forum where are represented all areas for which water is a strategic resource, such as business, government, irrigation, technology companies, laboratories, manufacturers of equipment, operators of water and wastewater treatment plants or desalination. It is also aimed to generate new business opportunities and knowledge synergies. EFIAQUA is at last the Mediterranean fair of knowledge for efficient water management with a global vision.

EFIAQUA's ambition is to become an international showcase of trends, innovations and solutions for the industry by promotion of networking. In addition, it will offer other business activities as an area for the presentation of new products and services and

conferences areas for industry knowledge and networking activities.

EFIAQUA targets to become an international meeting point, a forum where Spanish companies show consumers worldwide technology, both in the exhibition and in the practical application.

Water and energy are two fully integrated elements so their management and technological aspects that contribute to their optimization will be very present due to the synergies generated with other events that make up the Fairs Environment and Energy.



INNOVATIONS IN WASTEWATER TREATMENT

March 22nd , 2016
Leeds, UK

The main objective of this conference that takes place within the "11th IWA Specialist Group Conference on Wastewater Pond Technologies" is to examine those technologies that have recently emerged and been successfully applied for resource recovery at a commercial scale. As well as learning of how these technologies have been applied and the benefits they bring, it will help to inform

delegates as to what makes a successful research project and how the impact of such projects can be optimized. It will also look to the future and examine other potential resources that might be recovered economically and consider the best approaches to ensure the commercial success of any research initiatives investigating such routes.

Innovations in Wastewater Treatment

22 March 2016
Leeds University Business School, UK

MORE INFORMATION:

Project manager:

Laura Pastor (DAM)

Av. Benjamín Franklin, 21

Parque Tecnológico

46980-Paterna

Valencia (ESPAÑA)

Tel. +34 902881510

Fax +34 963531225

laura.pastor@dam-aguas.es

Partners:

Alberto Bouzas (UV/CALAGUA)

alberto.bouzas@uv.es

Denis Mangin (UCBL/LAGEP)

denis.mangin@univ-lyon1.fr

<http://www.phorwater.eu>

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LIFE+ PHORWater Newsletter is part of awareness raising and dissemination of project results LIFE12 ENV/000441 "Integral Management Model for Phosphorus recovery and reuse from Urban Wastewater", which is beneficiary Depuración de Aguas del Mediterráneo and where participate as partners the research groups CALAGUA and LAGEP. The project is 50% funded by the European Commission.