Main results and lessons learned

Maria João Rosa, Rita Ribeiro (LNEC)

International Final Conference
Lisbon | LNEC | December 5, 2019

Remembering the project’s context in 2014...
Fulfilment of objectives

Improving current barriers for controlling pharmaceutical compounds in urban wastewater treatment plants

✓ To produce valuable knowledge for water resource protection from PhCs and associated environmental policy on PhC occurrence, concentration and control in WWTPs, bacterial antibiotic resistance and PhC bioaccumulation in clams

✓ To demonstrate measures for improving the control of pharmaceutical compounds (PhCs) in urban wastewater treatment plants (WWTPs) with conventional activated sludge (CAS) treatment

3-level innovation
3-level innovation... key results

- Procedures for PhCs' quantification in wastewaters, sludges and clams (TRL 9)
- Performance assessment system for a sound identification and monitoring of the improvement strategies (TRL 7)
- New high performing PAC produced from pine nut shell residues (TRL 7)

2-year data of PhC occurrence in 2 urban CAS-WWTPs (~9000 results) from where we:

- characterized the PhC occurrence and its variation with temperature & precipitation
- understood how far can we go in PhC control in current urban-WWTPs, and identified the recalcitrant PhCs and those with intermediate and variable removal for which extra measures are needed
- derived a 4-class PhC framework for interpreting and predicting the PhC treatability in urban CAS-WWTPs (from A-easily removed to D-recalcitrant)
- identified low capex, low energy strategies for improving current barriers for PhC control in urban CAS-WWTPs, these being:
  - operation strategies (e.g. F/M ratio control) TRL 9, full-scale demo
  - PAC-enhanced treatment strategies (dosing eco-friendly PAC to the biological reactor) TRL 8, long-term pilot & short-term full-scale demo
3-level innovation... key results

On anti-microbial resistance

- a total of almost 7000 antibiotic-resistant colonies were isolated from raw and treated wastewater samples
- antibiotic test susceptibility of 300 antibiotic-resistant isolates showed resistance to two or more antibiotic groups (incl. to 3rd generation cephalosporins)
- multiresistance (to 3 or 4 antibiotic groups) were found in ca. 30-60% of the isolates from raw water samples and in ca. 12-35% of the isolates from treated wastewater samples
- 198 resistant genes (mainly CTX-M type genes, responsible for resistance to b-lactams) were found from these isolates

On PhCs in receiving waters

- three 1-month field campaigns (2016, 2017, 2018) of clams exposure to a gradient of WWTP discharge in Ria Formosa, Algarve (where 90% of the PT production of clams occur), from where we propose that:
  - *Ruditapes decussatus* (a clam species) is a suitable bioindicator of PhC bioavailability in real water environments, better than the water samples’ data
  - PhC uptake & bioaccumulation depend on PhC properties, abiotic and biotic factors
**3-level innovation... key results**

- **Collaborative work** was developed with a stakeholders’ panel to characterize:
  - their perceptions and attitudes towards PhC use and release in the environment
  - intangible costs and benefits of their control in urban WWTPs (an input to the CBA)

---

**3-level innovation**

- 2-year data of PhC occurrence in two urban CAS-WWTPs
- anti-microbial resistance
- PhCs in receiving waters
- Procedures for PhCs’ quantification
- Performance assessment system
- New high performing PAC
- Collaborative work
More results in www.life-impetus.eu

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

O conteúdo desta publicação é da exclusiva responsabilidade dos seus autores e não reflete necessariamente a posição da União Europeia. Nem a EASME nem a Comissão Europeia são responsáveis pela utilização das informações contidas na mesma.

LIFE14 ENV/PT/000739
Improving current barriers for controlling pharmaceutical compounds in urban wastewater treatment plants
www.life-impetus.eu