BONUS CLEANWATER PROJECT

Periodic publishable summary report 1st April 2018 to 31st March 2019

1 Project outline of goals and results envisaged at the beginning of the project cycle
BONUS CLEANWATER focuses on the removal of micropollutants and microplastics from wastewater as means to decrease the loads of the Baltic Sea by eco technological approaches. Thus CLEANWATER focuses in this phase on the link between carbon loading and removal in biological systems.

2 Work carried out in the project
Several new transformation pathways for micropollutants have been identified. Others have been identified by means of a literature review and verified for the designed systems. In WP1 Discharges into the Baltic have been quantified by a model-based approach, building on existing measurements of micropolllutants and microplastics. In WP 2 Ozonation, the ozone dose dependent formation of ozonation products has been determined. In WP 3 Moving Bed Biofilm reactor (MBBR), different approaches to modifying carbon doses have been tested successfully and an extensive set of valuable data is being processed. The big MBBR has been moved from Lundåkra to Avedøre (Figure 1). In WP 4 Membrane processes the Biomimetic Forward Osmosis (BMFO) reactor is working well – currently rejections rates are > 95% for all compounds. The Membrane bioreactor (MBR) is up and running and the WP is working on finding optimal operation conditions. In WP 5 Biofilters, results are produced with a multitude of reactors of different sizes. In WP 6 Cost and life cycle assessment, is collecting the data generated by the other work packages and is starting to process these data according to plan. In WP 7 Novel methods, the work on the innovative analysis for determination of micropollutants is finished while the improvements of the determination of microplastics is continuing as planned. In WP 8 Dissemination, is on-going, via conferences, publications (scientific and to the broader public), etc.

Figure 1 Moving the big MBBR pilot from Lundåkra to Avedøre.

3 Main results achieved during the project
Sources: Most inputs into the Baltic Sea will be introduced via dry weather WWTP effluents. Only where there are sources discharging with the rainwater (e.g. biocides), stormwater will be the main source. Combined sewer overflow will only outpace dry weather wastewater effluents for compounds with very high removal in the WWTP.

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Results from the technology work packages:

The ozonation products are formed indeed during ozonation. Their formation is dependent on ozone doses. On the other hand it turned out that these ozonation products can be destroyed/removed again at higher ozone doses. It thus seems cost-efficient to run ozonation at specific ozone doses around 0.5-0.8 mg O₃/mg DOC, however to remove these ozonation products ozone doses of 1.0-1.2 might be needed.

Considering the MBBRs it was found out that metabolic boosts by BOD can be achieved for some compounds, though probably more can be achieved by complex adaption processes (Figure 2).

Figure 2 Biodegradation of different pharmaceuticals in MBBRs adapted to the same conditions but incubations conducted under different BOD (acetate) loading. – Testing for metabolic boost. Chuanzhou et al., Wat Res., 2019, 159, 302-312 (courtesy to the authors).

4 The continuity plan of the project

The project is following its initial plan. Within the runtime of the project:

- According to plan, the appointed technologies will be systematically optimised to achieve higher and more complete removal rates.
- According to plan, sensing and determination will be further expanded for microplastics.
- Cost and life cycle assessments will be performed in the last year of the project as appointed.

Beyond the runtime of the project:
Future activities are discussed and decided upon in the steering committee in the last year of the project.