

Impact based Micro-Pollutant removal with a Natural and Energy neutral Technology (IMP-NET)

INTERREG BALTIC SEA

Offer for a project proposal under: INTERREG BALTIC SEA REGION 2021-2027

Introduction

The overall programme objective constitutes the umbrella for the Interreg Baltic Sea Region Programme 2021-2027:

'To put into practice innovative, water-smart and climate-neutral solutions through transnational cooperation for the benefit of the citizens across the Baltic Sea region.'

The Programme has been aligned with the EUSBSR (European Union Strategy for the Baltic Sea Region) and its action plan in order to maximise benefits for the BSR citizens. Interreg Baltic Sea Region covers nine countries, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden and one-third of Norway. The Programme targets public authorities at local, regional and national levels, business support organisations, specialised agencies, and infrastructure and service providers as the main forces responsible for the structural transition into a more resilient and innovative region. The Programme also emphasises citizen involvement through NGOs.

This proposal introduced hereunder is dedicated to Programme objective 2.1: Sustainable waters. More specifically it focuses on the sub-objective of 2.1: **adapt existing solutions, develop and implement new solutions, in order to prevent and reduce water pollution.**

Challenge

Micro-pollutants come from products that are part of everyday life and improve the lives of millions of people, but they cause great harm to Nature. Antibiotics save millions every year, but large amounts end up in Nature causing resistance development. Plastics are a big part of the modern world, but chemicals from these cause many problems in ecosystems. Birth control pills are an important part of people's lives but cause a large effect on aquatic life populations.

The Baltic Sea is a unique environment with its brackish water which give the region a unique but low biodiversity. The water exchange rate is also slow and causes any pollutants released into the environment to have a long persistence. The combination of these two aspects results in an ecosystem that is more sensitive to micropollutants than other marine areas¹.

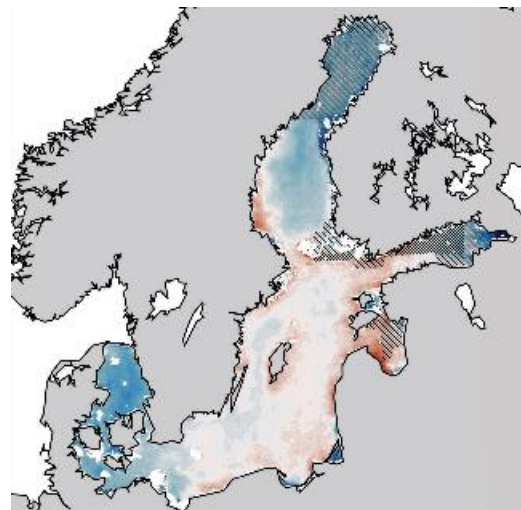


Figure 1. The Baltic Sea has, with its unique eco-system, has a high sensitivity to pollution

¹ Magnusson, K and Norén K (2012) The sensitivity of the Baltic Sea ecosystems to hazardous substances. Swedish Chemicals Agency Report PM 9/12

Current solutions, such as ozone and activated carbon, have been proven to be expensive, energy-intensive and complex to implement, even though a large amount of money has been spent on these technologies to try and improve them. These drawbacks have led to a prolonged dialogue where it in general boils down to weighing cost versus benefit, and during this time most resources have not gone so much to explore the environmental effects and to look into alternative technologies. Instead, it has gone toward models for cost- and responsibility structures and the concentrations found in different upstream and downstream areas.

The result of this is that most of this discussion has been absent from the public discussion, even though this is one of the main pollution challenges we have today. The studies that have caught the interest of the public are the ones conducted in living organisms^{2,3,4}, though they are far apart.

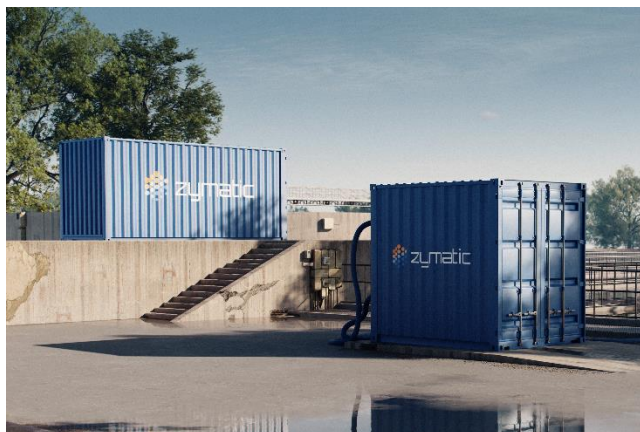
A major development is a new draft for the Urban Wastewater Directive and Surface water and groundwater pollutants Directive from the EU in October 2022⁵. This will set a requirement for urban wastewater treatment plants to remove specific micropollutants from wastewater, and for local agencies to reduce the amount of specific pollutants found in surface- and ground-water. This should be done in combination with the wastewater treatment plant's need to become energy-neutral.

The challenge is to find solutions that are cost-effective, energy-efficient and with high efficiency toward these pollutants. At the same time, there is a great need to highlight this environmental issue to the public to increase public pressure to accelerate the progress of preventing these pollutants from reaching Nature.

Pharem Biotech AB and the Zymatic technology

Pharem Biotech is a clean tech company that was founded 2013 in Uppsala, Sweden. We have since established ourselves as an innovative company within the fields of water treatment and biotechnology. The company operates mainly from its headquarters located in Södertälje, where most of the product development takes place.

By utilizing broad biotechnology expertise and in-depth knowledge of water treatment, Pharem's mission is to develop efficient water treatment solutions based on the Natural degradation of pollutants by enzymes. The applications provide effective means of removing micropollutants in water environments. The platform technology allows great flexibility to meet client needs for simple, effective solutions to tackle difficult pollutants in both industrial and municipal wastewater. This is represented by the [Zymatic](#) technology platform.



The Zymatic solution uses a combination of enzyme-, material- and immobilization technology to deliver a sand-like material that is easy to implement in the same way as a sand-filtration step and minimizes installation costs. By applying different types of enzymes, it is possible to apply both a broad or a very specific degradation of pollutants, all according to customer demands. The enzymes need no additives or energy to function, and in the combination of being a natural compound, offer a safe and energy-independent

² <https://www.nature.com/articles/nature.2013.12434>

³ <https://www.smithsonianmag.com/smart-news/analysis-australian-aquatic-animals-reveals-traces-more-60-pharmaceuticals-180970746/>

⁴ <https://www.scientificamerican.com/article/estrogen-in-waterways/>

⁵ https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6278

mechanism to the Zymatic platform. The main benefits of the platform are:

- Green technology
- Safe and simple
- Low cost

This solution has been validated in an urban environment by a [Horizon 2020 project](#), and has commercially been successful within the pharmaceutical industry, for example [AstraZeneca](#).

Project main objective and activities

Main objective: Demonstrate the environmental and economic impact in the Baltic Sea region of a natural enzyme-based technology for removing micro-pollutants in urban wastewater treatment.

- By implementing new and alternative technology, the project will demonstrate how we can overcome several of the challenges of current best practice technologies by demonstrating:
 - Lower cost.
 - Lower energy and carbon footprint.
 - Removal efficiency equal to or better than the current best practice.
- Quantify the environmental impact in the Baltic Sea of micro-pollutant removal by measuring the impact in adjacent waterbodies of the effluent water according to current best standards. This is done by:
 - Measuring and monitoring the concentrations in surface-, groundwater and sediment.
 - Measuring and monitoring the effect on the microbiology composition in the nearby water. (Similar to what was done at Knivsta⁶)
 - Measuring and monitoring the level of pollutants found in relevant aquatic life. (Similar to earlier stated sources)
- To reach maximum communicative impact the goal is to use the measurement of the environmental impact as the basis for communication. This should be done by an NGO or other non-commercially interested party.

The project work packages (WP) will include:

WP 1: Preparatory Actions, including preparatory work and installation of Zymatic in selected water treatment sites. State-of-the-art analysis and starting values for the measured and observed levels of pollutants in affected water bodies. Dissemination of the current state of affected water bodies

WP 2: Piloting and evaluation, including active operation of the Zymatic installations. Observing and measuring the development in affected water bodies. Dissemination and evaluation of the progress.

WP 3: Transferring of results, including a summary of the Zymatic implementation to be readily available for interested parties. Active promotion of results for public interest and relevant organisations. Plan for continued implementation of Zymatic at sites within the project.

Partnership design

To build a strong consortium for the effective implementation of the project proposal the project will bring together the following organisations alongside the Zymatic value chain:

- Wastewater treatment plants/Municipals at separate locations around the Baltic Sea to serve as demonstration sites. For relevance, we will include a minimum of 3 sites.

⁶ <https://www.sciencedirect.com/science/article/pii/S0048969720365219#bi0005>

- Research institutions participating in the analysis, measuring and monitoring of the environmental and ecological impact.
- NGOs for communication and dissemination activities regarding organic micropollutants and their impact on the Baltic Sea.

Summary

There are many challenges that need to be solved to reach the goals set by the new EU directives and within the goals of the EUSBSR. The main challenge is generally reduced to the cost of these technologies, and we aim to not only solve this problem, but also expand the scope to include additional challenges such as energy neutrality and the lack of dissemination that catches the interest of the public.

The issue with organic micropollutants is that they are the cause of many well-known effects such as antibiotic resistance, hormone disruption or plastic chemical uptake in humans and wildlife, but often fail to highlight the cause of micropollutants. We believe that this project can be a platform that can both show-case that there are viable, cheap solutions out there and at the same time highlight the cause of the ecological effects by also demonstrating how this can improve the environment in one of our most vulnerable sea regions within Europe, the Baltic Sea.

We hope that you would like to be part of this project proposal and for further information, do not hesitate to contact us:

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