GREENWATERTECH-2

Green remediation technologies to remove synthetic organofluorine chemical compounds from water

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Abstract

Per- and polyfluoroalkyl substances (PFAS) exposure has been linked to a range of adverse health effects. PFAS are ubiquitous in the environment, with over 14,700 unique compounds listed in the EPA's DSSTox database. These synthetic chemicals are highly water-soluble, enabling them to spread far from their sources, contaminating surface and groundwater and entering drinking water supplies globally. In the EU, 65% of drinking water is sourced from groundwater, and approximately 20 million people are directly exposed to PFAS through their water supply. These "forever chemicals" are designed to resist degradation, persist in the environment, and bioaccumulate in ecosystems, posing significant challenges for water quality and human health.

This project brings together a consortium of leading research institutions and industry partners from four EU countries to develop advanced modular hybrid technology (MHT) systems for the sustainable removal of PFAS from water. By leveraging cutting-edge chemical analysis techniques, we will assess the presence of PFAS in various water bodies and treatment processes. The project will focus on the evaluation of MHT systems using both model waters and real wastewater, with the aim of transforming polluted water into drinking water quality and enabling circular water use.

Building on the successful outcomes of a previous Horizon Europe "Aquatic Pollutant" Co-fund project, which demonstrated the feasibility of HMT technology in eliminating emerging pollutants, including pharmaceuticals from wastewater treatment plants, this project will expand and refine the MHT concept specifically for PFAS removal. We will investigate novel synergies within MHT modules, developing advanced nanoadsorbents and thermo-photocatalytic treatment units that integrate feedback regeneration for safe and efficient operation. New methods for synthesizing and dispersing pseudo-enzymatic adsorbents on natural carriers, alongside bio-based polymer matrices and functionalized silicates, will be explored. Additionally, an advanced oxidation process (AOP) using photocatalyst-coated glass fibers and luminous textiles will be developed, upscaled, and integrated into the MHT system to enhance PFAS degradation.

To address the critical need for sustainable and effective water treatment, we will also focus on developing innovative reactor designs to improve AOP efficiency and enable in-situ regeneration of saturated adsorbents through a unique refluxing process. This approach will minimize the need for external maintenance or disposal of spent materials. The project's results will provide valuable experimental data to guide sustainable water management practices and inform EU policies regarding PFAS regulation.

Current PFAS removal methods, including filters, membranes, and adsorbents like activated carbon and biochar, are costly, inefficient, and generate waste that requires further treatment. These methods also struggle to capture ultra-short PFAS compounds. Our proposed MHT approach could offer a cost-effective, sustainable alternative by directly eliminating PFAS without the need for additional treatment or disposal of the collected compounds. This approach has the potential to reduce the environmental spread of PFAS, lessen the burden on central wastewater treatment plants, and facilitate water reuse in industrial settings. Industry partners will be actively involved from the outset, contributing to the dissemination, exploitation, and commercialization of the project's results, ensuring that the technology reaches the market and has a significant impact on PFAS management and water treatment practices. Specifically, an ecological, technical and economic impact analysis of project results will be made.

Project coordinator

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Project partners

- SWEDISH UNIVERSITY OF AGRICULTURAL SCIENCES: SVERIGES LANTBRUKSUNIVERSITET - SWEDEN
- TALLINN UNIVERSITY OF TECHNOLOGY - ESTONIA
- BROCHIER TECHNOLOGIES - FRANCE
- CPE LYON - ENGINEERING GRADUATE SCHOOL OF CHEMISTRY, PHYSICS, DIGITAL SCIENCES AND TECHNOLOGY - FRANCE
- INSTITUTE OF INORGANIC CHEMISTRY OF THE CZECH ACADEMY OF SCIENCES - CZECHIA
- UMEÅ UNIVERSITY - SWEDEN

Funding organisations

FORMAS (SWEDEN) / ETAG (ESTONIA) / ANR (FRANCE) / TA CR (CZECHIA)

Duration

3 years

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KEYWORDS

PFAS, forever chemicals, water contamination, bioaccumulation, wastewater treatment, PFAS removal technologies, Nanoadsorbents, thermo-photocatalysis, advanced oxidation processes