



## The background

Emerging contaminants have been a focus of attention by the scientific community for many years and, more recently, by supervisory bodies, both at European and national levels. It is a very broad category of chemical substances - found in the environment in concentrations in the range of ng/l - µg/l - persistent and biologically active.

Their presence is ubiquitous and widely found in aquatic environments all over the world. The most frequently discussed emerging pollutants can be regulated in the future, based on their (eco)toxicity, their potential effects on human health and the monitoring data concerning their presence and persistence in the various environmental compartments.

The release of these substances into the environment can occur mainly through municipal and industrial wastewater discharges.

The latter is the case of microplastics. The European EEA report shows that about 8% of European microplastics released into the oceans come from synthetic fabrics: between 200,000 and 500,000 tons of microplastics from textiles enter the marine environment every year. This happens despite the fact that most microplastics come from textile production or washes (in Europe) are already retained by wastewater treatment plants, which, however, generate sludge rich in microplastics.

In the **LIFE CASCADE** project, the two most critical categories of emerging pollutants for the textile sector have been selected as a target: poly- and per- fluorinated compounds (**PFAS**) and **microplastics (MPs)**. The partners have always been in direct contact with the textile sector and support textile companies on their path towards the green deal.

In their journey, limiting the use of these substances in input to reduce their presence in the environment is explored as a reasonable route that some textile companies are already voluntarily operating. However, for some products and contaminants this is difficult to implement and therefore both prevention and removal strategies should be pursued in parallel. Furthermore, some of these substances are particularly persistent and have been used over the decades by several industrial sectors (case of PFAS).

## The project goals

The project is aimed at developing and applying methods and tools for removing those diffused micropollutants from the environment and in particular from water, the ecosystem mostly affected by those substances, coming especially from textile processes.

In this context, a fundamental role is played by wastewater treatment plants in the control of environmental pollution: since the full implementation of the Urban Waste Water Directive (EU) 2024/3019, such systems play a key role in removing contaminants from the environment.

A series of treatment technologies aimed at removing PFAS and Microplastics from wastewater both at the level of textile companies and at the level of centralized wastewater treatment plants at a laboratory scale and testing at a demonstrative scale will be developed with the aim of to identify the best and feasible combination to be implemented in a textile district.

## The steps to achieve this goal are as follows:

- Characterization of textile wastewater, specific textile process streams, influent and effluent of centralized wastewater treatment plants in terms of PFAS and microplastic after the implementation of analytical protocols for wastewater and sludge test (PFAS, Total Organic Fluorine and Adsorbable Organic Fluorine and MPs)
- Design, development and testing of pollution removal technologies for MPs and PFAS
- Evaluation at laboratory scale and testing at demonstration scale
- Measure and assessment of the environmental impact on territory with monitoring campaigns of river and lake water and evaluation of ecotoxicity

## Started activities

In the first year of the project:

- optimized test methods for the analysis of PFAS and MPs were developed and validated on complex matrices of interest;
- the analyses for the characterization of influents and effluents in the various treatment steps of 3 centralized wastewater plants in the Como district have been completed in terms of PFAS, MPs and conventional parameters;
- the characterization of wastewater and process streams of 10 textile companies in Italy and 6 textile companies in Portugal, with more than 60 process discharges investigated, is being completed;
- plants for the removal of MPs and PFAS at laboratory scale have been built and the investigation for their optimization is underway;
- demonstrative scale plants are being built at the centralized wastewater plants;
- first laboratory experiments to evaluate the ecotoxicity from effluents of WWTPs, to River Cosia and Lake Como water are performed.

## Partner

