UNESCO-IWRA ONLINE CONFERENCE
17-19 JANUARY 2023
3RD IN THE IWRA ONLINE CONFERENCE SERIES

Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Determination of microplastics in wastewater samples from two wastewater treatment plants in Spain and in a managed aquifer recharge system

Albert Contreras Llin

January 18th, 2023 - 09:25 CET

unesco
Programme hydrologique intergouvernemental

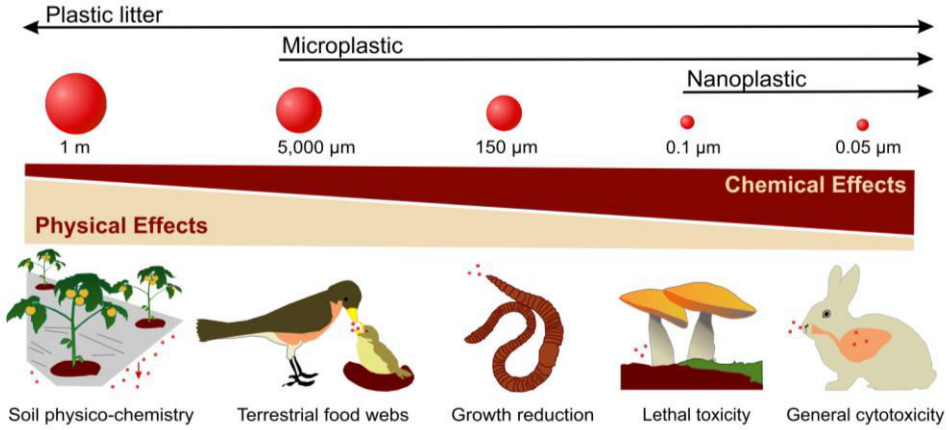
IWRA International Water Resources Association

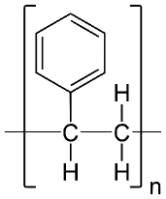
Introduction

MICROPLASTICS are any synthetic solid particle or polymeric matrix, with regular or irregular shape and with size ranging from 1 µm to 5mm, of either primary or secondary manufacturing origin, which are insoluble in water [1]

MPs could cause **chronic toxicity**, which is considered as a key issue in long term exposure

- Toxicity could be directly caused by the polymer materials used for manufacturing plastic products, especially their **monomers**.
- Inflict damage on organisms and cause inflammation due to their **small size** and **sharp ends**.
- **Additives** or hazardous compounds attached to them.





Polystyrene

WWTPs have been identified as one of the most important source of PLASTIC RELEASE, which may lead to further CONTAMINATION of the aquatic and terrestrial environments

1. Frias JPGL, Nash R ; *Mar Pollut Bull* **(2019)** 138, 145–147. DOI: 10.1016/j.marpolbul.2018.11.022.
2. De Souza Machado et al..; *Glob. Change Biol* **(2018)** 24:1405–1416 DOI: 10.1111/gcb.14020

Objectives

Life REMAR & Restora projects

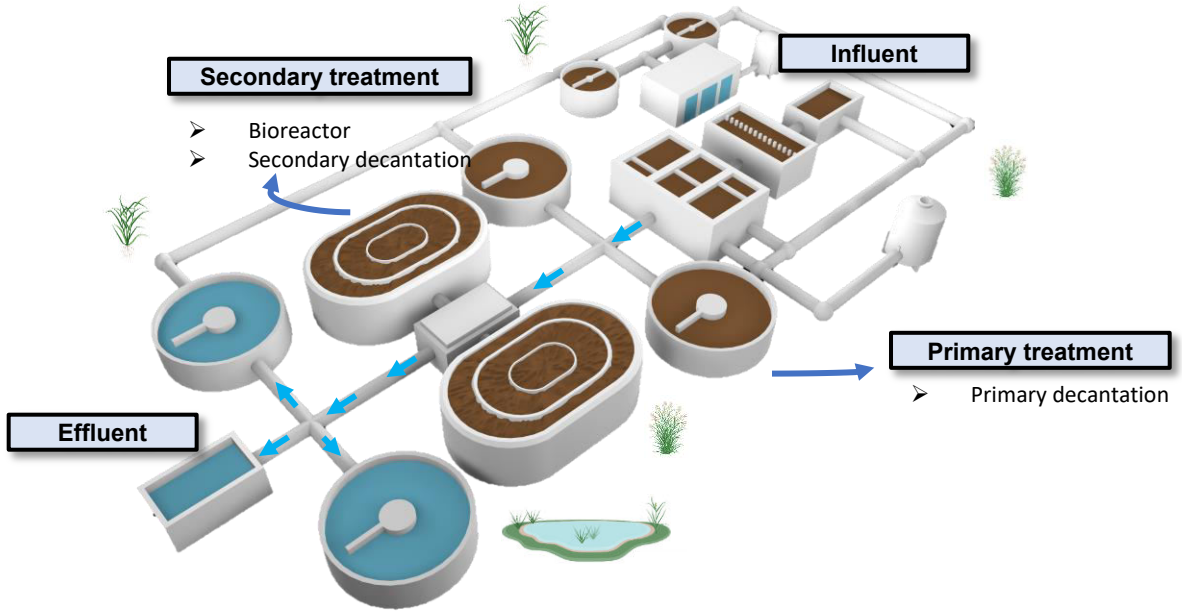
✓ Renaturalization of reclaimed water through managed aquifer recharge (MAR) system.

✓ Use of reactive barriers to reduce pollutants and attenuate their total loads.

✓ Within these projects, reactive barriers will be tested in two WWTP located in Cambrils (Tarragona) and Palamós (Girona)

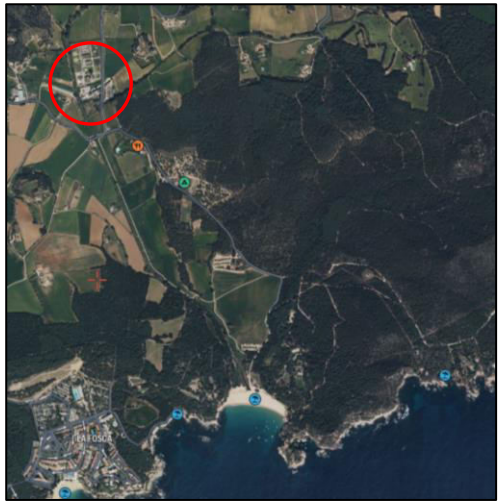
CHARACTERIZATION of MPs along the treatment process of both WWTP and in the MAR system.

Study sites



Cambrils WWTP

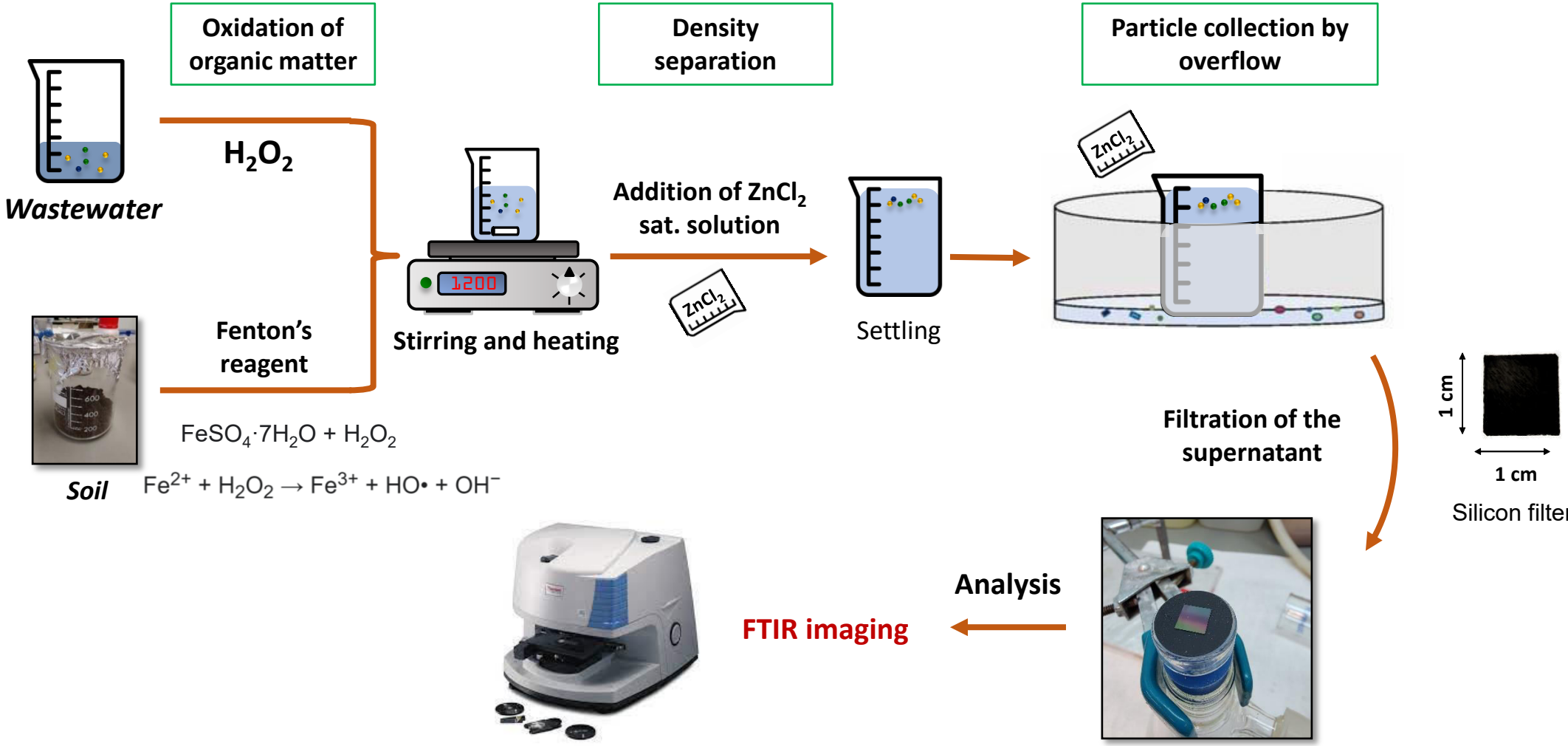
- Location: Cambrils, Tarragona
- Population eq.: 125.000 inhabitants
- Treatment: Primary and secondary



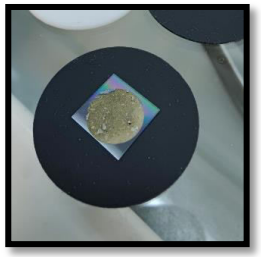
Palamós WWTP

- Location: Palamós, Girona
- Population eq.: 165.450 inhabitants
- Treatment: Primary and secondary

Sample treatment



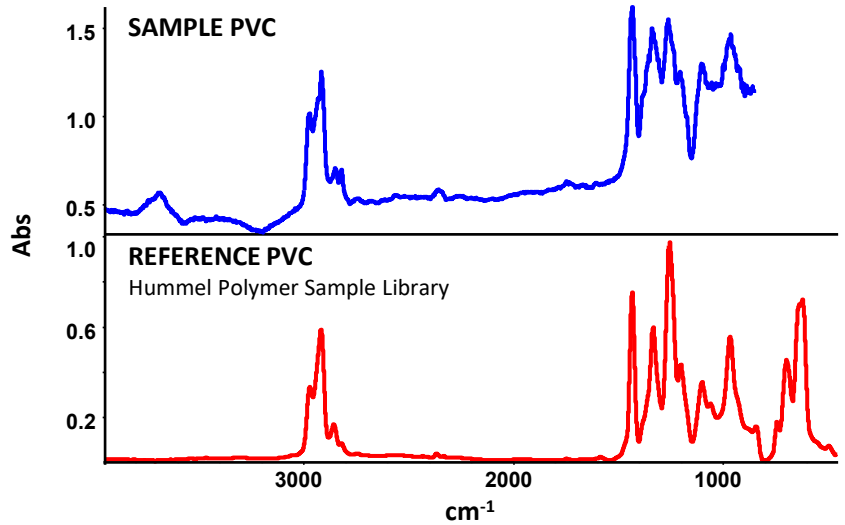
Characterisation & quantification



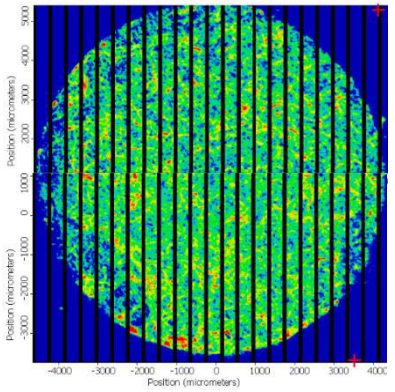
Analysis

Nicolet™ iN™ 10 MX

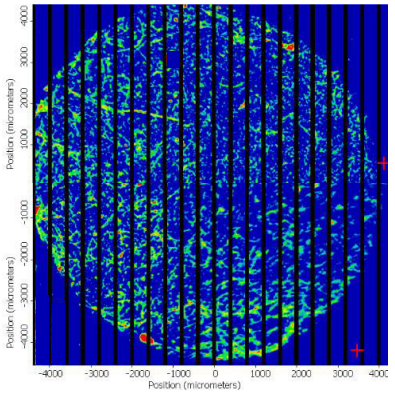
FTIR IMAGING was performed on the filter and results were compared with REFERENCE DATABASES.



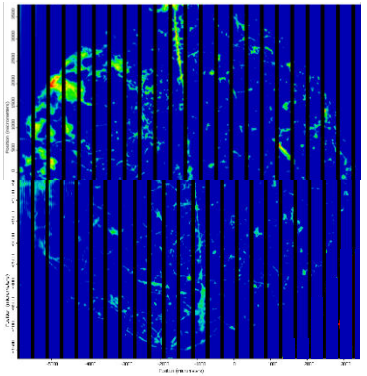
Influent



Primary effluent

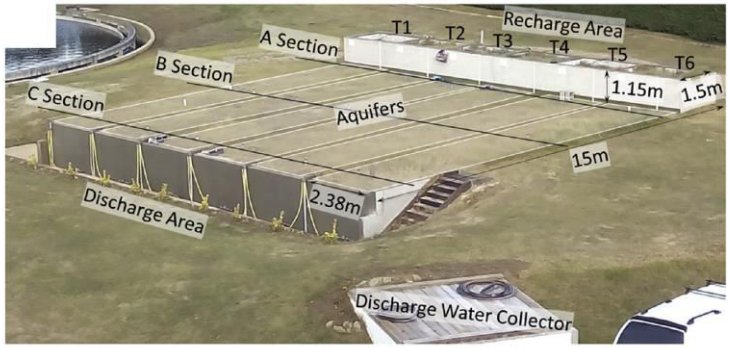


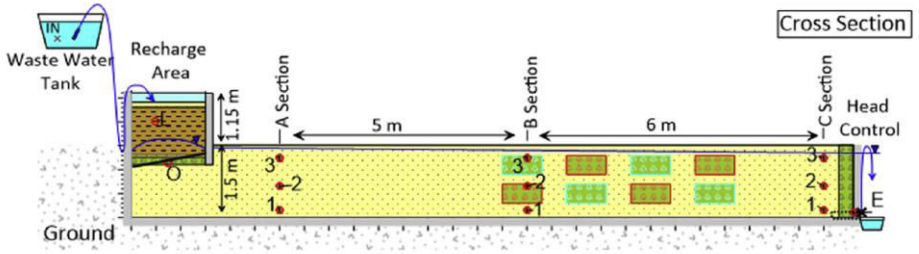
Secondary effluent



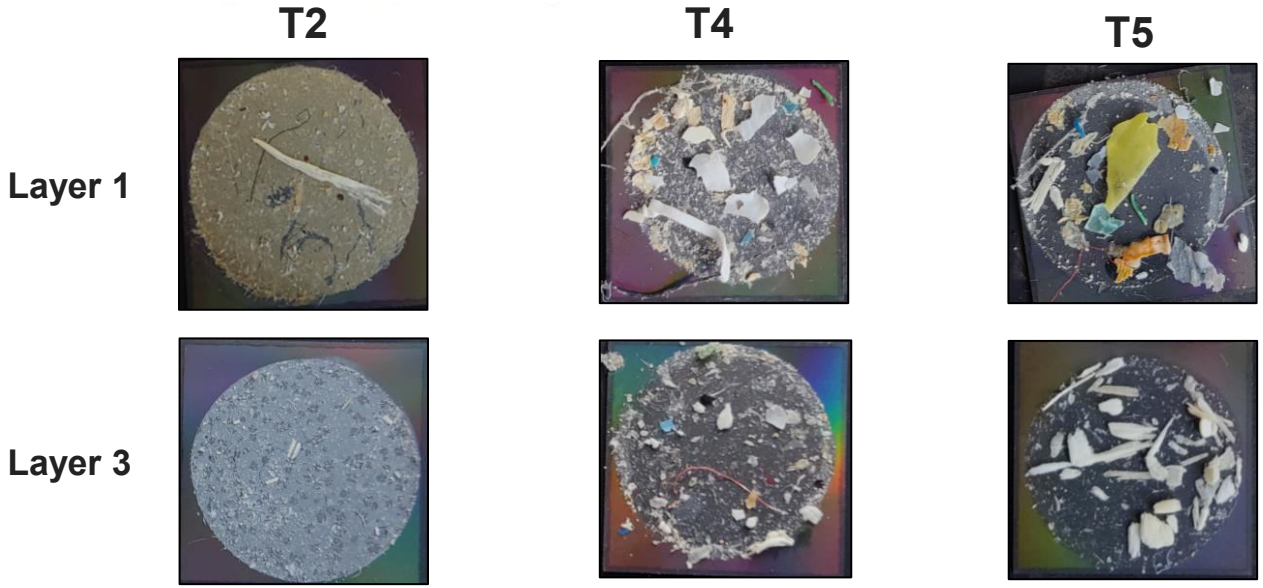
Reactive barriers

Palamós WWTP **MAR SYSTEM** → **Infiltration with the secondary effluent from the WWTP**





Barrier	Sand	Compost	Woodchips	Clay
T1, T3, T4	✓	✓		✓
T2	✓			
T5	✓		✓	✓
T6	✓	✓		✓

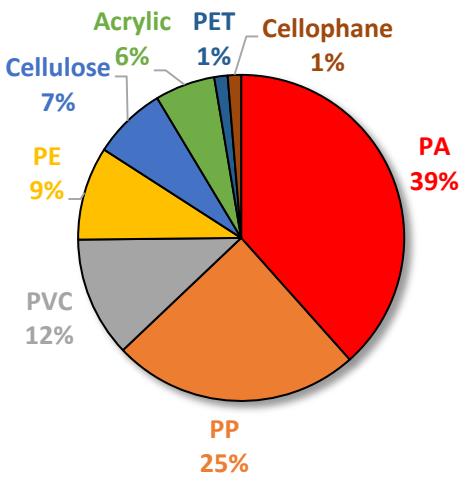


Solid samples from T6 were collected and analysed → **74%** **MPs retention on the barrier**

Characterisation & quantification

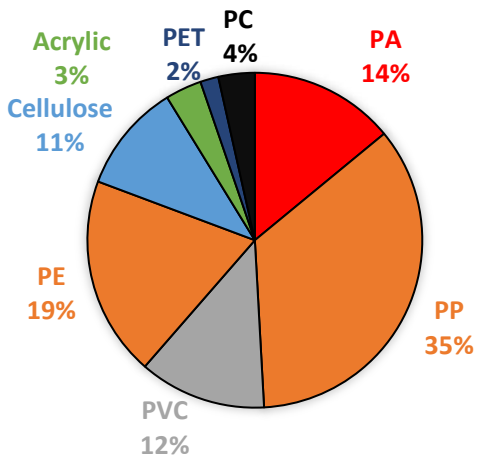
Cambrils WWTP

Influent



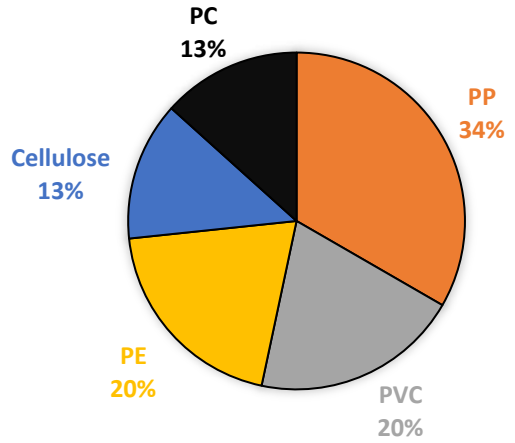
151 n/L

Primary effluent



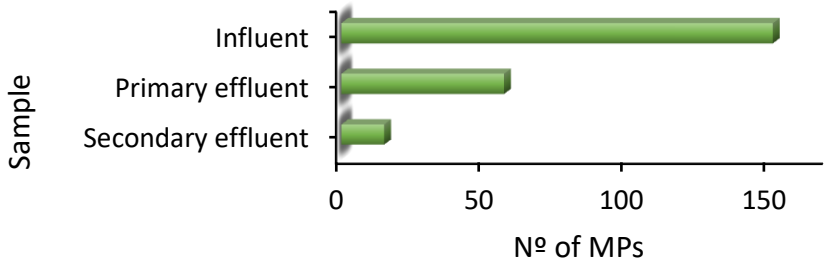
57 n/L

Secondary effluent



15 n/L

MPs content was greatly reduced. WWTP REMOVED ≈ 90% of MPs



REACTIVE BARRIERS will be tested to further increase MPs retention

Conclusions

✓ The method applied for the isolation of MPs allowed the correct and accurate extraction and posterior characterisation of MPs.

✓ Reactive barriers were sampled at different depths after secondary effluent infiltration in Palamós MAR system. Reactive barriers allow further retention of MPs.

✓ The content of MPs was greatly reduced throughout the treatment process in Cambrils. Palamós' WWTP is currently being sampled.

WWTPs treatments provide high elimination on MPs (> 90%). However, since huge quantities of MPs are reaching the site, still high amounts of particles surpass WWTPs and are released into the environment.

✓ Evaluate the performance of the reactive barriers on the retention of MPs. Propose new materials to further increase retention capacity.