Microplastics in freshwater environment: how they behave?

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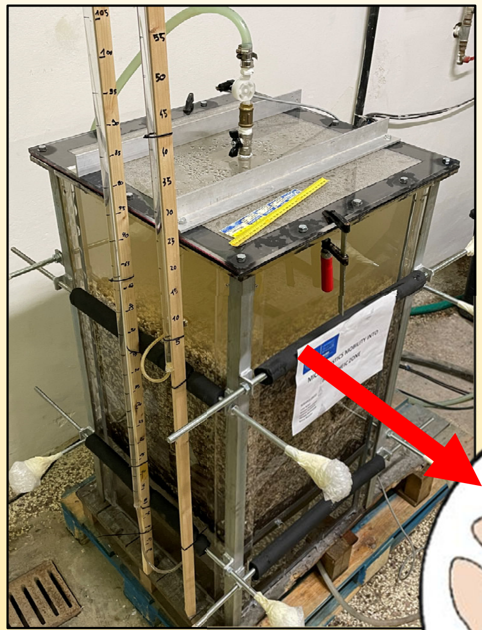
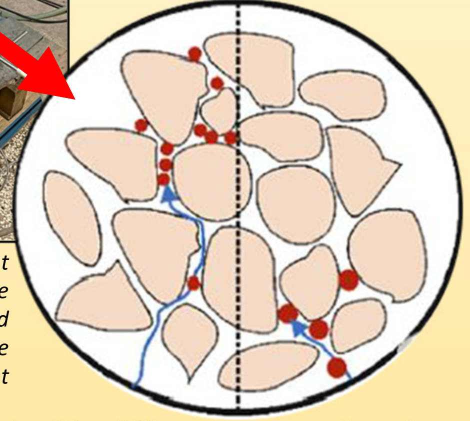
Microplastic mobility into hyporheic zone

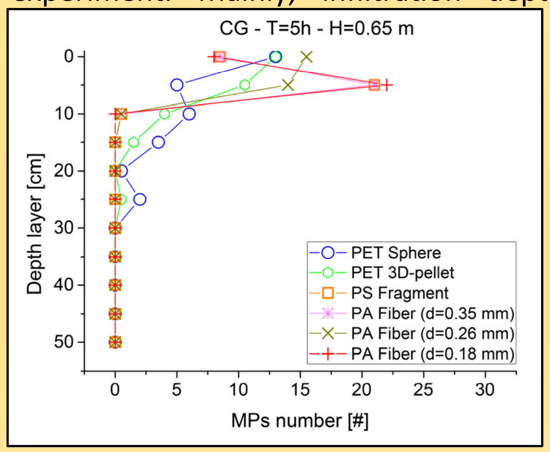




Experimental study on the infiltration capacity and the mobility of different microplastic types (MP) into riverbed sediments by varying hydraulic load conditions (H = 0.25m, 0.65m, 0.8m, 1m), time of experiment (1h and 5h) and size of sediment layer (coarse gravel, medium gravel and fine gravel).

Pressurized system to simulate different hydraulic load conditions. MP were placed on top of the sediment layer and at the end of the experiment they were counted considering 5 cm deep sediment layers.

The number of MP decreased with different power trends as the infiltration depth increased, for each type of soil considered and for each combination between hydraulic load and duration of the experiment. Mainly, infiltration depth (I_{DEPTH}) increases as the sediment size increases, reaching its maximum in the case of PET spheres. Thus, the ratio of sediment size to MP size and MP shape seem to be two fundamental parameters for the mobility of MPs within the hyporheic zone.

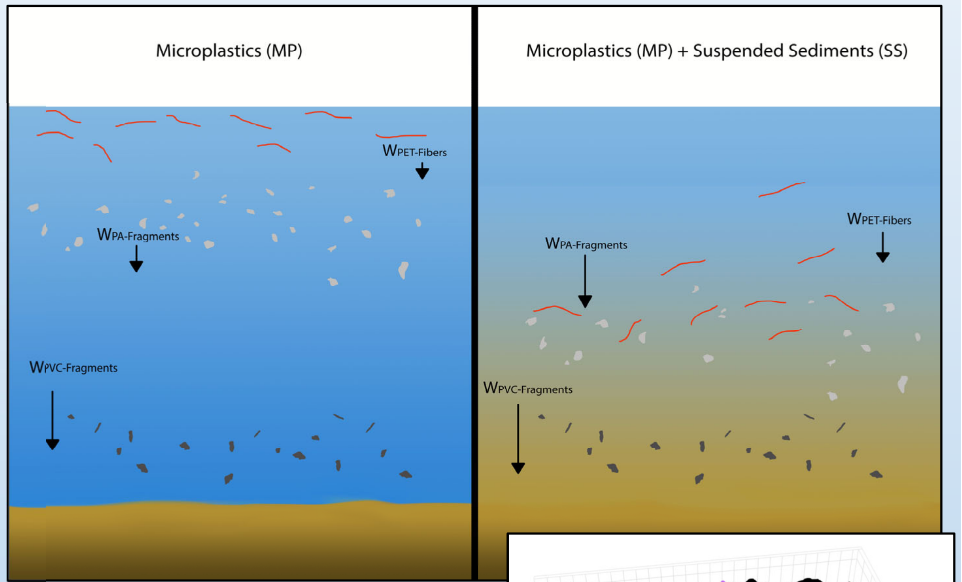


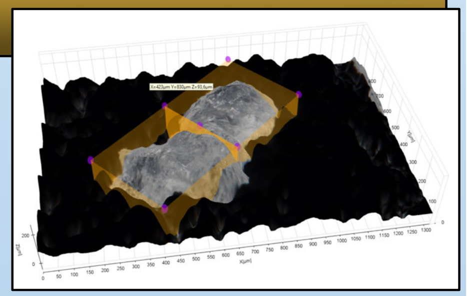
Concentration profiles of different MP type in the case of coarse gravel (CG), test time (T = 5h) and hydraulic load (H = 0.65 m).

M.Mancini, S.Francalanci, L.Innocenti, D.Martuscelli, L.Solari, Microplastic mobility into hyporheic zone: preliminary laboratory experiments. International Symposium on Ecohydraulics, Oct 10-14, 2022 Nanjing, China.

Suspended sediments mediate microplastic sedimentation in unidirectional flows

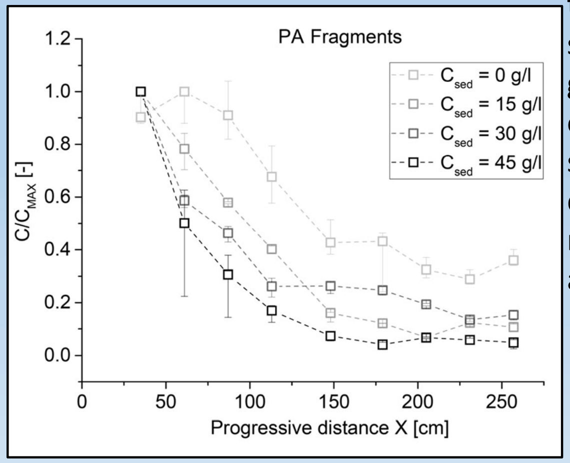
Work about the interaction between microplastics (MP) and suspended sediment for three different MP particle types (Polyamide (PA) and Polyvinyl Chloride (PVC) fragments, and Polyethylene Terephthalate (PET) fibers), and four different sediment concentrations (C_{SED} = 0 g/l, 15 g/l, 30 g/l and 45 g/l).





Above: MP exhibit different settling velocities (W) depending on whether they are in clear water or not. To the right side : the 3D-image reconstructions of MP particles obtained with an optical microscope (ZEISS SteREO Discovery.V12 - objective PlanApo S 1.5x) *coupled with software* Deltapix InSight v6.5.3.

Horizontal profiles of the PA fragments normalized concentration ($C/C_{S\text{-}MAX}$) along the flume to vary C_{sed}



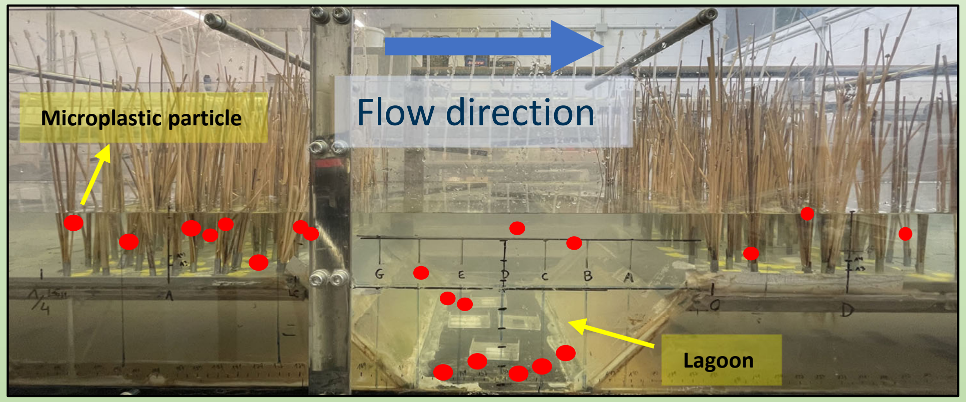
Sediment increased the vertical transport of MP to the bottom. The greater the sediment concentration, the greater the downward flux of MP. Sediment particles scavenged PA fragments downwards at the highest rate, followed by PET fibers and finally PVC fragments.

M.Mancini, T. Serra, J. Colomer, L. Solari, Suspended sediments mediate microplastic sedimentation in unidirectional flows (2023) – under review.

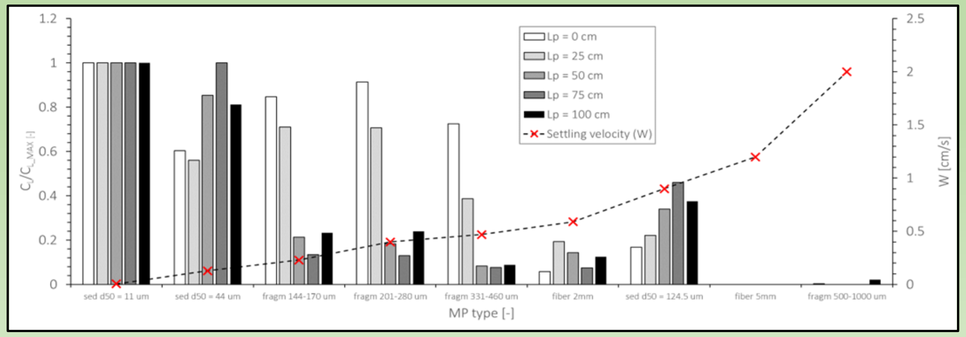
Interspersed lagoon and aquatic vegetation increase microplastic retention by modifying wetland hydrodynamics

Experimental study on the role played by both aquatic vegetation (*Juncus Maritimus*) and interspersed lagoons in shallow water areas in retaining MP particles. Six different types of MP (PA fragments, PVC fragments and PET fibers, each one in two size ranges) and five different patch lengths (L_P= 0 cm, 25 cm, 50cm, 75 cm, 100 cm) of the vegetation were considered.

PA and PVC fragments used in this work



Flume set-up with the juncus maritimus patches (Lp = 25 cm) surrounding the lagoon. MP traps were situated at the bottom of the shallow water areas and inside the lagoon to acquire samples. A laser particle size analyzer was used to obtain particle size distribution.



Normalized concentration of different particle types found inside the lagoon by varying Lp. Red dots indicate settling velocity measured for each type of particles.

The MP concentration inside the lagoon (C_L) depended on both L_P and the MP settling velocity (W). In general, C_L decreases as the Lp increases showing the key role of the aquatic vegetation in protecting lagoon by MP pollution.

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