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Preliminary assessment of microplastic abundance and spatial distribution along the surface water pathway of the Arno River (Central Italy)

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In recent years microplastics (MPs), classified as plastic debris of 1-5000µm in size, have been increasingly found in freshwater systems. As a result, growing concerns have been raised about their potential health risks. Tons of plastic waste are produced and degraded in man-made areas, and drainage waterways undergo a severe denaturation, thus playing a key role in MPs pollution of marine environments.

Along its pathway, the Arno River (Central Italy) receives anthropogenic solid load from municipal discharges, textiles industries, and urban drainage, before flowing into the Mediterranean Sea: this makes it a vulnerable and stressed river basin, where more than 2.5 million citizens live. Arno River was investigated for MPs contamination in water and sediment at 7 sites, located upstream the main pollution sources (i.e., urban centres) up to the river mouth. Water sampling (30L) was performed in the centre of the river in April and July 2022, to highlight seasonal variability. At two selected sites, water was also collected from the riverbanks. River runoff data were collected at each site to allow mass load calculations of MPs. Water samples were sieved (60µm) in situ to obtain aliquots of MPs>60µm and MPs<60µm, observed by visible light microscopy and fluorescence microscopy (Nile red dye), respectively.

Data show higher MPs concentrations (items/L) in the <60µm fraction than the >60µm at all sites and in both seasons, with a decreasing trend in average items size moving from upstream (20-27µm) to the downstream (7µm). Blue and black fibres are the most common colour and shape in MPs>60µm, while fragments are the only shape found in MPs<60µm. Increasing concentration trends are highlighted from the upstream sites to the city of Florence, where the highest value ($8.5x10^4$ items/L) is recorded during the wet season. Decreasing concentration trends are observed along the second half of the river pathway. Here, mouth MPs fluxes are +96% compared to upstream, and up to $5x10^{13}$ MPs of all size are estimated to be discharged daily to the Mediterranean Sea during the wet season.

Studies are in progress to investigate river sediments, and to characterize the type of polymers by µ-FTIR analysis.