Spatial distribution of microplastics in floodplain sediments of the river Loire (France)

Camille Croiset*†[1], Elie Dhivert[2], Ngoc-Nam Phuong[1], Cécile Grosbois[2], Aurore Zalouk-Vergnoux[3], Agnès Baltzer[4], and Johnny Gasperi[1]

[1]Eau et Environnement – Université Gustave Eiffel – Allée des Ponts et ChausséesRoute de Bouaye 44344 Bouguenais Cedex, France

[2]GéoHydrosystèmes Continentaux (EA 6293 GéHCO) – Université de Tours – Faculté des Sciences Parc de Grandmont Tours 37200 cedex, France

[3]Institut Des Substances et Organismes de la Mer – Nantes Université - UFR des Sciences Pharmaceutiques et Biologiques, Nantes université - UFR des Sciences et des Techniques – 2, rue de la Houssinière BP 81227 44322 NANTES CEDEX 3 France, France

[4]Littoral, Environnement, Télédétection, Géomatique – Université de Brest, Université de Rennes 2, Centre National de la Recherche Scientifique, Nantes Université, Littoral, Environnement, Télédétection, Géomatique UMR 6554 – Institut de Géographie et dÁménagement de lÚniversité de Nantes Campus du Tertre BP 8122 44312 NANTES CEDEX 3, France

Abstract

Sediments from rivers, lakes, and other continental hydrosystems constitute important sinks for microplastics but remain a poorly studied compartment (Dris et al., 2018). Microplastic spatial distribution depends both on their intrinsic properties, and also on hydro-sedimentary processes. However, the understanding of MP depositional mechanisms within sediments remains fragmentary. In the vast majority of studies, these sediments are sampled without questioning hydro-sedimentary processes which may control the abundance of MP at different spatial scales (Dekiff et al., 2014; Mani et al., 2018).

In this context, 16 surface sediment samples were collected in a floodplain of the river Loire (over an 8 km^2 area). These samples correspond to different depositional environments with various connectivity levels and sediment compositions. After treatment of samples (organic matter digestion and densimetric separations), the quantities, types and sizes of microplastics in each sample were analysed by μFTIR (Fourier Transform Infrared Spectroscopy coupled to microscopy). In parallel, grain size distributions and total organic carbon contents were also analysed. The connectivity rate to the river flow was determined by combining sample altitudes and water level variations over the last decade.

Results show MP levels ranging between 1,110 and 19,342 items/kg dw (dry weight). A substantial spatial variability is illustrated over the floodplain. Analyzes are ongoing to explain this variability regarding : (i) the connectivity rate linked with the local topography and hydrological conditons, (ii) sediment composition as a proxy of hydro-sedimentary processes, (iii) the geomorphological functionning of sampled environments, and potentially (iv) surface land cover to determine whether vegetation has a significative impact on MP abundance in these flooplain depositional environments.

*Speaker

†Corresponding author: camille.croiset@univ-eiffel.fr

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