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Plastic flows (micro and nano) : Analytical development and environmental behaviour

MANON BOULAY[1,2], JENNIFER COCKING[3], ALEXANDER REY[4], PHILIPPE ARCHAMBAULT[2,5] AND JULIEN GIGAULT[1,2]

[1]Département de Chimie, Université Laval
[2]IRL Takuvik - CNRS - Université Laval - Sorbonne Université
[3]Ocean Diagnostics Inc.
[4]National Research Council Canada / Government of Canada
[5]Département de Biologie - Université Laval

Since 1950, global plastic production has increased significantly. This increase is largely due to their low production cost, high durability, and infinite properties. These properties make them particularly persistent waste in the environment. As major pathways to the ocean, rivers discharge 2.41 million tons of micro- and nanoplastics annually [1], pollutants that spread throughout all environmental compartments via winds and currents. There is currently little data on the main sources in rivers, particularly for nanoplastics, due to the lack of effective analytical strategies for collecting and analyzing plastics at this scale. Although some rivers are beginning to be studied, the St. Lawrence system remain largely unexplored at this scale (for nanoplastics).

The St. Lawrence River is one of the largest rivers in the world. Its size and proximity to more than 45 million people make it one of the most anthropized rivers in the world. Indeed, Langlois et al. showed that plastics were found at all sampling sites in the St. Lawrence River [2]. It's a very complex system fed by opposing currents from river inflows and ocean currents. These currents can be impacted by numerous eddies and ice cover during the winter.

The objective of this presentation is to present a study showing the distribution of microplastics in the St. Lawrence system, with unique spatial resolution. These samples were collected during several expeditions and therefore cover several seasons. Using an analytical method to analyze traces of microplastics and combining this data with particle dispersion models developed in collaboration with the Canadian NRC, we are attempting to determine potential sources and, above all, accumulation sites. Based on our results, it's clear that the St. Lawrence River is a significant source and accumulation area for this plastic waste in the northern hemisphere.

[1] – Lebreton, L.C., Van Der Zwet, J., Damsteeg, J.-W., Slat, B., Andrady, A., Reisser, J., (2017). River plastic emissions to the world's oceans. Nat. Commun. 8, 15611

[2] – Langlois VS, To TA, Larocque E, Gigault J, Lavoie RA (2025) Surface Water Microplastics in the St. Lawrence River and Estuary in Canada. PLoS One 20(4): e0315739