

Microplastics in deep water: a combined GC-MS e FT-IR approach

Enrico Davoli¹, Giancarlo Bianchi¹, Stefano Magni³, Andrea Binelli³, Luigi Falciola²

¹Dipartimento Ambiente e Salute, Istituto di Ricerche Farmacologiche Mario Negri IRCCS, Milano

²Dipartimento di Chimica Università degli Studi di Milano

³Dipartimento di Bioscienze, Università degli Studi di Milano

Microplastics are water-insoluble, solid polymer particles that are characterized by $1\ \mu\text{m} < \text{MP} < 1\ \text{mm}$ ¹. A lower size boundary has not been defined, but particles below $1\ \mu\text{m}$ are usually referred to as nanoplastics rather than microplastics.

The ubiquity of microplastics² of all sizes in surface water, groundwater and wastewater has raised the question if pollution of drinking water occurs and to date, few studies indeed described the presence of this new contaminant in tap and bottled water³.

Toxicity it is not yet known⁴, they might cause local inflammations in the gut, but a transport into organs might occur. CI SONO DIVERSI ARTICOLI CHE DIMOSTRANO L'INGRESSO NEI TESSUTI ANCHE DI MICROPLASTICHE

As a final problem in this field, microplastics in the environment are difficult to sample, to identify and standardized methods do not exist.

For this reason, we have been involved in a research project finalized to the definition of a protocol strategy for sampling and analysis of microplastics in drinking waters, coming from deep water wells, in the networks of three large cities in the Northern part of Italy.

The project is on going and presently two groups of deep water samples have been collected in the city of Milano and Brescia, before and after the treatment stages used for the urban network. Great attention has been paid to sampling and extraction steps as microplastic contamination, in this kind of samples, is expected to be very low⁵ and contamination during sampling might occur through air or materials. Analytical methods have been defined for the detection of main microplastic contamination, like PE/PP, PS, PA, PVC e PET residues $> 1\ \mu\text{m}$.

Samples have been analysed first by a non-destructive approach using a Spotlight 200i microscope equipped with a μATR probe and coupled to an FT-IR spectrophotometer, followed by a mass spectrometric characterization of the polymers by a solid phase microextraction (SPME) GC-MS of thermal decomposition products (TED) of microplastic residues.

Results will be presented and critically discussed.

(1) Hartmann, N.B., Huffer, T., Thompson, R.C., Hasselov, M., Verschoor, A., Daugaard, A.E., Rist, S., Karlsson, T., Brennholt, N., Cole, M., Herrling, M.P., Hess, M.C., Ivleva, N.P., Lusher, A.L., Wagner, M., 2019. Are We Speaking the Same Language? Recommendations for a Definition and Categorization Framework for Plastic Debris. *Environmental Science & Technology* 53, 1039-1047.

(2) *Marine Anthropogenic Litter*; Bergmann, M., Gutow, L., Klages, M., Eds.; Springer International Publishing: Cham, 2015. <https://doi.org/10.1007/978-3-319-16510-3>.

(3) Eerkes-Medrano, D.; Thompson, R. C.; Aldridge, D. C. Microplastics in Freshwater Systems: A Review of the Emerging Threats, Identification of Knowledge Gaps and Prioritisation of Research Needs. *Water Research* 2015, 75, 63–82. <https://doi.org/10.1016/j.watres.2015.02.012>.

(4) Koelmans, A. A.; Besseling, E.; Foekema, E.; Kooi, M.; Mintenig, S.; Ossendorp, B. C.; Redondo-Hasselerharm, P. E.; Verschoor, A.; van Wezel, A. P.; Scheffer, M. Risks of Plastic Debris: Unravelling Fact, Opinion, Perception, and Belief. *Environmental Science & Technology* 2017, 51 (20), 11513–11519. <https://doi.org/10.1021/acs.est.7b02219>.

(5) Mintenig, S. M.; Löder, M. G. J.; Primpke, S.; Gerdt, G. Low Numbers of Microplastics Detected in Drinking Water from Ground Water Sources. *Science of The Total Environment* 2019, 648, 631–635. <https://doi.org/10.1016/j.scitotenv.2018.08.178>.