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Atmospheric transport of micro and nanoplastics and fluorescence detection of particles < 20 µm

Angelica Bianco[1,3], Fabrizio Sordello[2], Mikael Ehn[1], Davide Vittorio Vione[2], and Monica Passananti[1,2]

[1]University of Helsinki, INAR – Institute for Atmospheric and Earth System Research, Helsinki, Finland (angelica.bianco@helsinki.fi)

[2]Dipartimento di Chimica, Università di Torino, Via Pietro Giuria 5, 10125 Torino, Italy

[3]now at Laboratoire de Météorologie Physique (LaMP), Université Clermont Auvergne (UCA), 63000 Clermont-Ferrand, France

Atmospheric plastic pollution is now a global problem. Microplastics (MP) have been detected in urban atmospheres as well as in remote and pristine environments, showing that suspension, deposition and aeolian transport of MP should be included and considered as a major transport pathway in the plastic life cycle. Due to the limitations in sampling and instrumental methodology, little is known about MP and nanoplastics (NP) with sizes lower than 50 µm, which is the current limit for FT-IR and Raman microscopy. In our recent work [Bianco et al. 2020], we describe how NP could be transported for longer distances than MP, making them globally present and potentially more concentrated than MP. We highlight that it is crucial to explore new methodologies to collect and analyse NP.

Small MPs can be detected by fluorescence spectroscopy: for example, particles can be efficiently stained using Nile Red, as described by Erni-Cassola et al. [2017]. This hydrophobic dye shows fluorescence in green and yellow range of the electromagnetic spectrum and can be easily detected also at low concentration. We are developing a new method, based on this principle, to detect MPs in natural matrices. These are, for instance, surface and atmospheric waters, containing dissolved organic matter and suspended organic particles. Preliminary results on polyethylene, polystyrene and polyvinylchloride are promising for particles in the range 1-25 µm suspended in MilliQ water. We are currently testing the method on river water and snow.

Bianco, A.; Passananti, M. Atmospheric Micro and Nanoplastics: An Enormous Microscopic Problem. Sustainability 2020, 12, 7327.

Erni-Cassola, G.; Gibson, M.; Thompson, R.; Christie-Oleza, J. Lost, but Found with Nile Red: A Novel Method for Detecting and Quantifying Small Microplastics (1 mm to 20 µm) in Environmental Samples. Environ. Sci. Technol. 2017, 51, 23, 13641–13648