**First overview of microplastics in indoor and outdoor air**

Johnny Gasperi1, Rachid Dris1, Cécile Mirande1, Corinne Mandin2, Valérie Langlois3,Bruno Tassin1

1 Université Paris-Est, LEESU, UMR MA 102, 61 Av Général de Gaulle, 94010 Créteil, France, gasperi@u-pec.fr.

2 Université Paris-Est, Centre Scientifique et Technique du Bâtiment (CSTB), 77447 Marne-La-Vallée, France.
3 Institut de Chimie et des Matériaux Paris Est, CNRS-UPEC-UMR7182, 2-8, rue Henri Dunant, 94320 Thiais, France.

The plastic production has increased rapidly from 1.7 to 288 million tons annually within the last 60 years ([PlasticsEurope, 2013](#_ENREF_3)). In the early 70’s, the presence of millimetric plastic debris in marine environment has been highlighted and more recently the term microplastics was used to describe millimetric and inframillimetric particles. Since 2008, plastic particles smaller than 5 mm have been defined as microplastics ([Barnes et al., 2009](#_ENREF_1)). These microplastics cover a large and continuous spectrum of sizes and shapes including 1D-fibers (with one larger dimension), 2D-fragments (flat particles), and 3D-spherules. While numerous studies were published on microplastic in marine environment, only few are dealing with these pollutants in continental environments. Moreover most of these studies are dealing with lakes and rivers, but none focused on the contamination of atmospheric compartment by microplastics.

In addition to experimentations on total atmospheric fallout ([Dris et al., 2015](#_ENREF_2)), this study aims at investigating the contamination of indoor and outdoor air by microplastics. Indoor air concentrations of microplastics (number of particles/m3) were measured in 2 private apartments and 1 office at the Paris-Est University. Volumes about 5 m3 over a 24h-period were pumped using a Deltanova pump (8 L/min) on glass fiber GF/A Whatman® filters (1.6 µm). In addition, household dust was also sampled using conventional vacuum cleaner and collected in the vacuum cleaner bag. Outdoor air samples were collected on the University roof located in an urbanized area (about 10 km from Paris center) and about 10 m3 were pumped over a same period. In both cases, the total dust sampling modes were considered. Filters were then observed with a stereomicroscope Leica MZ12 coupled with a software for image analyzing to account microplastics. For methodological reasons, the minimal microplastic particle size considered in this study is about 50 µm. For dust, a densimetric separation coupled with an enzymatic digestion was performed.

Microplastics observed in indoor and outdoor air are exclusively fibrous with a size distribution. Fibers are mainly sub-millimetric (50-80% between 100 and 500 µm) and to a lesser extent millimetric (10-30% between 500 and 1 000 µm or between 1 000 and 5 000 µm). First campaigns indicate that indoor concentrations are in the 3-15 particles/m3 range. A gradient of indoor concentrations according to the sampling height (30, 125 and 250 cm) was also observed suggesting that the microplastics are mainly re suspended from the floor probably due to human activity and movement. Finally, a significant amount of fibers is observed in dust. Outdoor concentrations are lower than those observed for indoor and are in the 0.2-0.8 particles/m3 range. Due to their size, a high deposition velocity of microplastics may be expected and could explain the low concentrations observed. Parallel to that, a significant amount of particles is also observed in total atmospheric fallout (29-280 particles/m2/d), confirming the contamination of atmospheric compartment by microplastics. The time-variation of this flux seems to be strongly influenced by rain events suggesting that the microplastic wash out could be a major route of deposition.

The chemical identification of the microplastics is in progress using Raman micro spectroscopy.

**References**

Barnes DKA, Galgani F, Thompson RC, Barlaz M. Accumulation and fragmentation of plastic debris in global environments. Philosophical Transactions of the Royal Society B-Biological Sciences 2009; 364: 1985-1998.

Dris R, Gasperi J, Rocher V, Saad M, Tassin. First investigations on the microplastic contamination in an urban area: the case of the Greater Paris. Enviromental chemistry, in press. 2015.

PlasticsEurope. Plastics – the Facts 2013, An analysis of European latest plastics production, demand and waste data. Plastics Europe, Association of Plastic Manufacturers, Brussels, 2013, pp. 40.