November 12-13 2024
RamanFest
Paris | FRANCE

Andrea Mario Rossi
Mara Putzu [a], Marta Fadda [a], Alessio Sacco [a], Korinna Altmann [b], Dmitri Ciornii [b], Vilde Kloster Snekkevik [c], Bert Van Bavel [c], Nizar Benismail [d], Andrea Mario Giovannozzi [a] and Andrea Mario Rossi [a]
a Istituto Nazionale di Ricerca Metrologica (INRiM), 10135 Torino (Italy);
b Bundesanstalt für Materialforschung und-prüfung (BAM), 12205 Berlin (Germany);
c Norwegian Institute for Water Research (NIVA), NO-0579 Oslo, (Norway);
d Nestlé Quality Assurance Centre (NQAC) 88800 Vittel, (France).

A.ROSSI@INRIM.IT

Standardization and Harmonization Effort on Microplastics Analysis by Spectroscopic Methods.

Plastic pollution is recognised as a severe anthropogenic issue globally, where complex physio-chemical transformation processes (such as aging, degradation and fragmentation) producing Microplastics (MPs, 1000-1 µm) and, subsequently, Nanoplastics (NPs, <1 µm). Plastic debris comes in a huge range of sizes, polymer types, levels of physicochemical degradation and associated chemicals, therefore a combination of different sampling, sample processing and analytical techniques is needed. To date, many different analytical protocols, methods and techniques have been developed and applied to samples containing multiple polymer types and certain fractions of particle size. However, validated standardized methods remain unavailable at this point.
The most common techniques to reliably identify MPs are micro-Spectroscopy (Infrared or Raman) or Thermo-Analytical methods [1]. While the mass-based thermo-analytical methods can determine the overall mass of different polymer types (LOD in the µg range), the particle-based spectroscopic methods provide information on the polymer type, number, size and size distribution, and potentially identify a single polymer particle in the sub-micron range. While several studies provided a path forward to harmonization, there is an urgent need for collaborative method development, (certified) reference materials and inter-laboratory studies (ILS) to validate and harmonize the various methods (including how to report results) [2]. These efforts and tools are needed to enable a better assessment of data quality and to develop a more efficient and reliable measurement infrastructure in support of (i) ECHA's proposed restriction targeting intentionally added MPs in consumer products, (ii) the Marine Strategy Framework Directive (MSFD), (iii) the new Drinking Water Directive (DWD) that mentions MPs explicitly, and (iv) the new Circular Economy Action Plan (CEAP) adopted in March 2020.
In this talk, an overview of the more recent standardization and harmonization activities will be presented, including i) European projects (eg. EUROqCHARM, 21GRD07 PlasticTrace) that critically review the state-of the-art of the analytical methods and take harmonisation one step further with the preparation of suitable reference materials for QA/QC and harmonisation of methodologies; ii) ILC studies to validate the performance of spectroscopy methods (µ-IR, µRaman) and thermogravimetric methods (eg. VAMAS TWA45); iii) International initiatives and cooperation at the ISO level (eg. ISO/TC 147/SC 2/JWG 1) to set out the key principles for the investigation of microplastics in drinking water and water with low content of natural suspended solids using vibrational spectroscopy, with a main focus on sample preparation, measurement methods, data processing, and method validation.

References

[1] Ivleva et al., Analytical and Bioanalytical Chemistry (2021) 413:5969–5994;
[2] Van Mourik et al., Science of the Total Environment 772 (2021) 145071; Authors, Journal, Issue (Year) page (