EMPIR Call 2016 – Energy, Environment, Normative and Research Potential

Selected Research Topic number: **SRT-v04**
Version: 1.0

Title: Quantitative Determination of Microplastic in Environmental Matrices

Abstract

The release and subsequent degradation of plastics have led to increasing amounts of microplastic particles in the environment The microplastic particles range in size from a few µm to 5 mm and the risks arising from them are still unknown as there is currently no reliable data on the sources, quantity and effects of microplastic in the environment. This is due to a number of factors such as the lack of; reliable quantification procedures, reproducible procedures for field sampling (in water, solids and air), reference materials and methods for the traceable determination of mass fraction and particle size distribution of microplastics in the environment.

Keywords

Microplastics, pollution, microparticles, sampling, determination, standardisation, reference materials

Background to the Metrological Challenges

Currently, nearly 300 million tons of plastic polymers are produced worldwide annually and 8-12 million tons are estimated to end up in the oceans. The presence of microplastic particles < 5 mm is documented in oceans and beaches worldwide; and even in rivers inland waters, waste water plants and biota. Small microplastic particles can also enter the food chain and it is well documented that the adsorption of persistent pollutants can result in subsequent ingestion by animals and hence accumulation in the food chain. In addition, the quantity of microplastic in water systems is unclear and the impact of this contamination on ecosystems and human health remains unknown.

The EU Marine Strategy Framework Directive 2008/56/EC (MSFD) established a framework for EU member states to take necessary action to achieve or maintain good environmental status in the marine environment by the year 2020. Similar measures were also agreed at the G7 summit in 2015. However, there is a lack of rapid and practical methods for representative sampling and unambiguous and precise detection of small amounts of synthetic polymers in environmental matrices is needed in order to determine the fate of microplastics in the marine and terrestrial environments.

The specific challenge for the field sampling of particular microplastic – i.e. small microplastic contents in large matrix volumes - is currently not met by standardised sampling methods, which are only suitable for traditional low-molecular-weight and dissolved pollutants. Instead for soils, sediments and composts, a variety of standardised sampling instruments need to be adapted, and the representative collection of microplastic in waste water plants using (e.g. membrane pumps or filter cartridges) needs to be systematically investigated.

Standardisation of the three stages of microplastic analysis: 1) representative sampling; 2) reproducible sample preparation; and 3) traceable quantification and particle size distribution; is a necessity for the risk assessment of the effects of microplastics in the environment. Such risks include toxicological aspects (e.g. from adsorbed pollutants); and therefore a complete measurement chain from sampling, analysis and quality control is urgently needed, requiring joint cooperation between NMIs/DIs (method development and traceability) and environmental agencies (monitoring and field sampling expertise), in order to assess the quantity of microplastic in our water systems and the impact this is having on the ecosystems.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the

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overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol

The JRP shall focus on the traceable quantification and particle characterisation of microplastics encountered in the environment.

The specific objectives are

1. To develop reliable and reproducible sampling methods for relevant environmental matrices, that are capable of collecting microplastic particles from a few µm up to 5 mm from large sampling areas and volumes (up to many m^2 and m^3) and can withstand high levels of naturally suspended matter.
2. To establish accurate techniques for sample preparation. This should include the enrichment of microplastics in the sample prior to analysis as well as a reducing the amount of naturally occurring organic matter. In addition, to develop safe and appropriate disinfection methods for environmental sources such as sewage sludge and untreated waste water, in order to ensure that particle characteristics and chemical compositions are unaffected.
3. To develop methods for the characterisation of microplastic particles in environmental matrices. This should include the chemical composition, particle size distribution, polymer composition (used to determine the origin of microplastic in the environment); and quantification of the microplastic mass fraction in an environmental matrix with target detection limits of < 0.1 % and a target uncertainty of 5 %.
4. To develop traceable reference materials for particle size determinations of ≥ 100 nm and that are also suitable for use with irregular particle dimensions. Traceable reference materials should also be provided for the determination of microplastic mass fractions by appropriate pure polymer calibrants, as well as matrix based reference materials with clearly defined microplastic particle size distributions and mass fractions.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (commercial analytical laboratories), standards developing organisations (such as those linked to the MSFD 2008/56/EC) and end users (e.g. plastics industry, environmental monitoring and regulation bodies).

These objectives will require large-scale approaches that are beyond the capabilities of single National Metrology Institutes and Designated Institutes. To enhance the impact of the research, the involvement of the appropriate user community such as industry, standardisation and regulatory bodies is strongly recommended, both prior to and during methodology development.

Proposers should establish the current state of the art and explain how their proposed research goes beyond this and EMRP project ENV08 WFD.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 2.0 M€, and has defined an upper limit of 2.3 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 35 % of the total EU Contribution to the project.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the environmental and marine sectors.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.