MICROPLASTICS ANALYSIS WORKSHOP

Report

First QUASIMEME-NORMAN Microplastics
Interlaboratory Preparatory Workshop

27 & 28 November 2018, Vrije Universiteit, Amsterdam, The Netherlands

25 January 2019

Photo: P. Cenijn

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Synopsis

This Microplastics Analysis Workshop attracted over 110 participants for two fast-paced, informative days (27 & 28 Nov 2018). Participants engaged in open discussions on the quality assurance/quality control (QA/QC) needs of analytical laboratories and data users. High-quality presentations of microplastics analytical approaches in theory and practice were given by an excellent line-up of guest speakers and poster presenters. The VU-NIVA-QUASIMEME-NORMAN scientific organizing committee presented a proposal for a microplastics interlaboratory study, built up of consecutive rounds of sample analyses of increasing complexity and listened carefully to the feedback from the participants on their needs for the study design. The interlaboratory study now in preparation will be open (2019) to any microplastics analysis laboratory with an interest of joining a community that is engaged in learning exercises and increasing and demonstrating their proficiency with this notoriously challenging new target analyte class. The scientific program covered all aspects of the analysis of microplastics in environmental samples including sampling, identification of polymers, instrumental analysis, quantification, QA/QC, with a focus on an upcoming interlaboratory study.

Background

The Dept. of Environment and Health of the Vrije Universiteit has recognized the need for an open interlaboratory study on plastic particles and teamed up with interlaboratory study providers QUASIMEME, the NORMAN Network and NIVA to meet this need. The event was organized by Heather Leslie, Louise van Mourik, Jacob de Boer, (VU E&H) and Bert van Bavel (NIVA), in collaboration with Steven Crum, Esther van de Brug of QUASIMEME, and Wim Cofino of QUASIMEME and NORMAN.

Introduction

'Microplastic' is a catch-all phrase for plastic particles spanning six orders of magnitude in particle size and a gigantic variety of chemical compositions: (co)polymers, chemical additives, residual monomers, fillers, catalysts, non-intentionally added substances (NIAS) etc. The diversity of this analyte class gives rise to a search for a mix of methodologies to answer the burning questions in microplastic research and to scientifically support plastic pollution mitigation policies under consideration by state and non-state actors. The Microplastics Analysis Workshop held in November 2018 in Amsterdam was dedicated to the topic of microplastics analysis and was open to all technicians and scientists working in the field of analysis of microplastics in environmental matrices. The workshop was a prelude to the organisation of a worldwide microplastics interlaboratory study (expected in 2019).

Workshop goals

The purpose of this workshop on the analysis of microplastics was to bring the analytical community together to discuss the available methods and how to possibly improve the quality and reliability of the analysis as well as to achieve better harmonization of microplastics data being produced. In particular input was sought from the expert analytical community for the design of an interlaboratory study that would meet the needs of the laboratories who are up for the analytical challenge that plastic particles present.

Workshop Outcomes

A community of microplastics analytical laboratories has been established, with the majority of participants eager to participate in the upcoming interlaboratory study. Feedback on the community's needs will be incorporated. The interlaboratory study will be inclusive and built up out of different rounds. The key questions addressed in the workshop are discussed below.

What do we understand as "QA/QC of microplastics analysis" and what can it do for the science and understanding of microplastics?

Quality assurance comprises all actions carried out to plan the proper performance of the analytical task. Quality control comprises all operational techniques and activities that are used to fulfill the requirements for sufficient quality of the analysis. These two definitions are not different for microplastics than for chemical analyses. The difference with chemical analyses, such as contaminant analyses, is that for microplastics QA/QC criteria are not established yet. QA/QC may also be a relatively new concept for those not experienced in chemical analysis. The strongest QA tool is an interlaboratory study because it provides information on method related differences in the results of the measurements; in fact it mimics a real analysis of – in this case – microplastics for which the answers are unknown to the participants. Other tools such as the use of internal reference materials, quality control charts, good quality standards, etc., are also very useful and should be incorporated in microplastics labs. Obviously, most tools still need to be developed. A good collaboration between the community of microplastics labs will surely help in this development.

How can we improve QA/QC of microplastics analysis and create fit for purpose analytical methods?

Participants commonly agreed on the usefulness of an interlaboratory study. In addition, they particularly called for improved methods for the identification and quantification of the microplastics as well as for guidelines. It was decided to start with a stepwise-designed interlaboratory study. The target range of microplastic size led to some discussion. The organizers will try to keep the entire study as open as possible for participants with different interests in terms of size and type of microplastics and matrices.

What analytical methods are currently being applied?

A broad range of analytical methods are currently being applied, from visual to laser-based techniques to mass spectroscopy. The workshop included a number of very interesting presentations on the various techniques available worldwide. Fourier Transform InfraRed (FTIR) spectroscopy including µFTIR was one of the most reported methods. Another spectroscopic technique, Raman, is also widely used. Stimulated Raman Scattering (SRS) microscopy, based on the coherent interaction of two different laser beams with vibrational levels in the molecules of the sample, was presented during the workshop. This technique enables a much faster detection of microplastics. It is still in development and costs involved may be relatively high. Pyrolysis gas chromatography (GC) combined with mass spectrometry is promising for the identification and possibly also for the quantification of microplastics, although it lacks the option of counting particles. A number of different pre-treatment techniques were mentioned as well as sampling techniques such as the manta trawl.

Workshop Highlights

- We should be aware of the mistakes we regularly make and QA/QC helps us to identify and avoid them as much as possible
- Pyrolysis GC/MS is promising and can also be coupled to Orbitrap.
- Stimulated Raman Scattering microscopy s highly advanced but still in development
- Guidelines for microplastics are under construction by a variety of other bodies (OSPAR, GESAMP, TSGML)
- Certified refence materials are not available yet, but the EU Joint Research Centre has expressed an interest in working on it as soon as legislation will be developed.

Takehome messages

- Microplastics is a very diverse class of target analytes
- Checklists and guidelines are desirable when planning analyses
- Exposure assessment requires high (known) quality controlled data.
- Disconnect between measured concentrations of micro-sized-plastic particles and toxicity testing (nanosized plastic particles)
- Interlaboratory studies are best built up from simple samples to complex samples in a series of rounds
- Beyond marine – microplastics analytical methods can be applied to a variety of other matrices

Acknowledgements

The organisers thank the VU-E&H grad students and staff who contributed to the smooth and pleasant running of the workshop: Deepti Siddhanti, Glenn Spiessens, Martin van Velzen, Peter Cenijn and Renate Mooij.

Workshop facts at a glance

27 & 28 November 2018

110 participants

24 countries represented

18 oral presentations

3 interactive discussion sessions

13 poster presentations

3 poster sessions

0 single use plastic items used

Annex 1. How to participate in Microplastics interlaboratory study

To get involved, to subscribe for updates and/or participate in the upcoming first round of the interlaboratory, send an email to quasimeme@wur.nl (or one of the organising committee members below) and keep an eye on the www.quasimeme.org and the E&H websites. An invitation will be sent to all workshop participants.

Annex 2. About the organisers, contact information and websites

QUASIMEME Laboratory Performance Studies, part of Wageningen University and Research, Quality Assurance of Information in Marine Environmental Monitoring operates a series of Proficiency Testing Studies for institutes making chemical measurements worldwide. As part of the improvement programme, QUASIMEME co-operates with centres of excellence to provide workshops for discussion, and "hands on" experience to complement the development programmes in the Laboratory Performance Studies. http://www.quasimeme.org

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Dept. of Environment & Health, Vrije Universiteit Amsterdam acts as a Centre of Excellence for QUASIMEME. It contributes to biological test material testing for proficiency tests on environmental organic contaminants and microplastics. In addition, scientific advice is given to the annual QUASIMEME programmes through the Scientific Advisory Board. It assists in organizing workshops on specific analytical topics. E&H combines knowledge on analytical chemistry and toxicology to address a broad range of chemical pollution issues. www.science.vu.nl/environmentandhealth

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NORMAN Network of reference laboratories, research centres and related organisations for monitoring of emerging environmental substances https://www.norman-network.net/

NIVA the Norwegian Institute for Water Research, Oslo, is Norway's leading institute for fundamental and applied research on marine and freshwaters. Its research comprises a wide array of environmental, climatic and resource-related fields. NIVA's world-class expertise is multidisciplinary with a broad scientific scope. It combines research, monitoring, evaluation, problem-solving and advisory services at international, national and local levels. https://www.niva.no/en

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