Immobilised microplastic particle models for method evaluations and laboratory ring trials in the lower micrometer size ranges

Robin Lenz*†[1,2], Kristina Enders[1,2], Julia Muche[2], Franziska Fischer[2], Josef Brandt[2], Eva C. Vizsolyi[3], Martin Löder[3], Christian Laforsch[3], Gabriele Eder[4], Matthias Labrenz‡[1], and Dieter Fischer§[2]

[1]Leibniz Institut für Ostseeforschung Warnemünde – Seestraße 15, 18119 Rostock, Germany
[2]Leibniz-Institut für Polymerforschung Dresden e.V. – Hohe Straße 6, D-01069 Dresden, Germany
[3]Universität Bayreuth – 95440 Bayreuth, Germany
[4]OFI Österreichisches Forschungsinstitut für Chemie und Technik – Franz Grill Str. 5, Arsenal Objekt 213, 1030 Wien, Austria

Abstract

Quantification of microplastics (MP) from real world samples require manifold and labour-intensive steps of sample purification, as well as chemical and or optical analysis. A large variety of methods for each step has been described in the scientific literature, oftentimes accompanied by calls for more standardisation and reproducibility. One important factor for reliable results is to be able to estimate error terms introduced by individual methods or whole methodological pipelines. Such trials, on a per-method basis typically referred to as method evaluation or validation, or, from an interlaboratory perspective, as calibration or proficiency test, tend to resort to experimental designs involving much larger plastic items, than what the respective method might be applied to afterwards. The reason here, bluntly, is that the correct determination of numbers, shapes, and sizes of freely floating, rolling and swirling particles is difficult to assure for everything that is too small to be handled manually. We developed techniques for MP particle immobilisations for experimental trials in the size range below 100 μm. The foundation of the concept is to enable repeatable measurements on individual MP particles. For a range of digestion method evaluations a fixation holding particles to the substrate, able to withstand the treatments, while also allowing a sufficient particle surface exposure, was required. This was realised as spin-coated epoxy resin microlayers on Si-wafers with scattered MP toppings, in order to measure the same particles before and after exposure to a chemical digestion protocol.

In ongoing developments we are applying the immobilisation concept in designing analytical laboratory comparisons, where we avoid the inaccuracies introduced in sample production and treatment in classical mobile particle approaches. In fact, with a sufficiently stabilised immobile MP sample, it becomes possible to conduct a ring trial where the identical sample is spectroscopically measured and then forwarded by all participants.

*Speaker
†Corresponding author: lenz@ipfdd.de
‡Corresponding author: matthias.labrenz@io-warnemuende.de
§Corresponding author: fisch@ipfdd.de

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