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Editorial

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Ensuring the quality of data on concentrations of microplastics in environmental samples

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The last decade has witnessed a very substantial rise in publications reporting on the presence of microplastics (MPs) in the environment. That human exposure is occurring is undeniable, given reports of the presence of MPs in a variety of human tissues[1-4]. Within the field of exposure science, attention has turned to establishing the pathways via which MPs enter the human body and the relative significance of those different pathways[5,6]. This article outlines fundamental procedures that all laboratories should follow to ensure that data required to undertake assessments of human exposure to MPs are reliable and robust.

The first essential requirement, from sampling to analysis, is to minimise contamination of the sample(s) to ensure that any MPs detected originate from the sample as it existed immediately prior to collection. This requires avoiding contact between the sample and any plastic - e.g., sampling personnel should avoid wearing clothing made from synthetic fabrics, and use metal or glass sampling equipment, and sample storage vessels. Once sample storage vessels are opened for MPs analysis, measures must be taken to minimise contamination. These measures can include but are not limited to: analysts wearing cotton lab coats[5,6], conducting all sample handling and analysis in a "clean room" equipped with an air filtration system, or, if that is not possible, performing analytical procedures in a clean air hood.

Despite the best efforts of those involved in sampling and analysis, the ubiquity of plastic in the modern world means some contamination of samples and/or sample extracts is almost inevitable. Consequently, it is essential to monitor the extent of such contamination on a frequent, regular basis via analysis of blanks - at the University of Birmingham, we analyse one blank for every five samples. In essence, blanks are "samples" in which all procedures applied to real samples are conducted in the absence of a real sample. For liquid samples, this typically consists of laboratory reagent water (which has been previously characterised for MPs content). The main types of blanks are: (1) a "field" blank, in which, e.g., a sample of laboratory water is placed into a sampling vessel, taken to the sampling site, and opened for the duration of the sampling event, before sealing and returning to the laboratory where it is treated as a "real" sample; and (2) a "laboratory" or "reagent" blank. In this latter case, the laboratory water does not travel to the sampling location but otherwise is treated as a "real" sample[5]. Analysis of both blank types is useful, as differences between them provide insights into where contamination occurs in the sampling and analytical procedures. However, analysis of only one type is acceptable. The choice of a blank matrix will differ according to the type of sample: a notionally clean solid, such as laboratory-grade sodium sulfate, is suitable as a blank matrix when analysing, e.g., indoor dust, soil, or sediment; an unused filter from the air sampling process will suffice for studying atmospheric contamination[6].

There must also be a standard protocol for "correcting" MPs data when blanks contain non-negligible quantities of MPs. In our laboratories, we compare MP levels in each blank to those detected in the batch of 5 samples analysed alongside that blank. We make no correction if the blank level is ≤ 5% of that in samples. If the blank level is between 5% and 20% of that in samples from that same batch, we subtract the blank level from those in samples. Finally, if the blank level exceeds 20% of that in samples, no data are reported for samples in that batch.

The accuracy and reproducibility of the measurements of MPs must also be assessed. If available, certified or standard reference materials (CRMs/SRMs) for which concentrations of MPs have been defined, must be analysed, with data obtained falling within the acceptable range reported. Where multiple CRMs/SRMs are available, the matrix that most closely matches the samples analysed in a given study should be used - e.g., when reporting data for indoor dust samples, an indoor dust reference material is ideal, but if not available, a solid matrix reference material, such as soil or sediment, may be used. If a suitable CRM/SRM is not available, as is currently the case for MPs, a "matrix spike" or "recovery QA sample"[6], consisting of a clean sample (e.g., laboratory reagent water[5] or an unused air filter[6]) to which known amounts of MPs are added, should be analysed. Such samples should initially be analysed in replicates (suggested $n = 5$) as part of initial method validation, thereby providing some indication of the reproducibility and accuracy; subsequently, they should be analysed after every 20 samples to provide ongoing verification of accuracy[5,6].

The above measures address the quality of data on concentrations of MPs without identification of which polymers make up those MPs. As with quantitative data, it is important to ensure that such qualitative data are reliable, and clear descriptions of how (e.g., via spectral matching) specific MPs are identified as a given polymer - e.g., polyethylene as opposed to polystyrene – and the degree of certainty associated with such assignment (e.g., 95% confidence), must be provided.

As research efforts into environmental contamination and assessment of human and wildlife exposure mature, it is essential that procedures such as those described above are followed, to ensure the quality of the data used for making important decisions aimed at minimising the adverse impacts of MPs on human and environmental health. At *Journal of Environmental Exposure Assessment*, we expect all studies to provide appropriate information that assures the quality of the MPs data reported.

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REFERENCES

1. Schwabl P, Köppel S, Königshofer P, et al. Detection of various microplastics in human stool: a prospective case series. *Ann Intern Med* 2019;171:453-7. DOI PubMed
2. Pironti C, Notarstefano V, Ricciardi M, Motta O, Giorgini E, Montano L. First evidence of microplastics in human urine, a preliminary study of intake in the human body. *Toxics* 2022;11:40. DOI PubMed PMC
3. Leslie HA, Van Velzen MJ, Brandsma SH, Vethaak AD, Garcia-Vallejo JJ, Lamoree MH. Discovery and quantification of plastic particle pollution in human blood. *Environ Int* 2022;163:107199. DOI PubMed
4. Ragusa A, Svelato A, Santacroce C, et al. Plasticenta: first evidence of microplastics in human placenta, *Environ Int* 2021;146:106274. DOI PubMed
5. Al-Mansoori M, Stephenson M, Harrad S, Abdallah MAE. Synthetic microplastics in UK tap and bottled water; Implications for human exposure. *Emerg Contam* 2025;11:100417. DOI
6. Ageel HK, Harrad S, Abdallah MAE. Microplastics in indoor air from Birmingham, UK: implications for inhalation exposure. *Environ Pollut* 2024;362:124960. DOI