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How to establish detection limits for environmental microplastics analysis

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ABSTRACT

Establishing analytical detection limits is crucial. Common methods to do so are suitable only for variables with continuous distributions. Because count data for microplastic particles is a discrete variable following the Poisson distribution, currently-used approaches for estimating the detection limit in microplastics analysis are inadequate. Here we evaluate the minimum detectable amount (MDA) in microplastic particle analysis, using blank sample data from an interlaboratory calibration exercise water (representing drinking water), dirty water (ambient water), sediment (porous media) and fish tissue (biotic tissues). Two MDAs are applicable: MDA_A to evaluate analytical methods, estimated with replicate blank data; and MDA_B for individual sample batches, calculated with a single blank count. For illustrative purposes, this dataset's overall MDA_A values were 164 counts (clean water), 88 (dirty water), 192 (sediment), and 379 (tissue). MDA values should be reported on a laboratory-specific basis and for individual size fractions, as this provides more useful information about capabilities of individual laboratories. This is due to wide variation in blank levels, as noted by MDA_B values (i.e., among different laboratories) from 14 to 158 (clean water), 9 to 86 (dirty water, 9 to 186 (sediment), and 9 to 247 (tissue). MDA values for fibers were considerably greater than for non-fibers, suggesting that separate MDA values should be reported. This study provides a guideline for estimation and application of microplastics MDA for more robust data to support research activities and environmental management decisions.

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