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Reevaluation of microplastics extraction efficiency with the aim of Munich Plastic Sediment Separator.

Mikhail Zobkov (1), Elena Esiukova (1), Aleksei Grave (1), Liliya Khatmullina (1,2)

(1) Atlantic Branch of P.P.Shirshov Institute of Oceanology, Russian Academy of Sciences, Kalinigrad, Russian Federation,
(2) Immanuel Kant Baltic Federal University, Kaliningrad, Russian Federation

Invading of microplastics into marine environment is known as a global ecological threat. Specific density of microplastics can vary significantly depending on a polymer type, technological processes of its production, additives, weathering, and biofouling. Plastic particles can sink or float on the sea surface, but with time, most of drifting plastics become negatively buoyant and sink to the sea floor due to biofouling or adherence of denser particles. As a result, the seabed becomes the ultimate repository for microplastic particles and fibres. A study of microplastics content in aquatic sediments is an important source of information about ways of their migration, sink and accumulation zones.

The Munich Plastic Sediment Separator (MPSS), proposed by Imhoff et al. (2012), is considered as the most effective tool for microplastic extraction. However, we observed that the numbers of marine microplastics extracted with this tool from different kinds of bottom sediments were significantly underestimated.

We examined the extraction efficiency of the MPSS by adding artificial reference particles (ARPs) to marine sediment sample before the extraction procedure. Extraction was performed by two different methods: the modified NOAA method and using the MPSS. The separation solution with specific density 1.5 g/ml was used. Subsequent cleaning, drying and microscope detection procedures were identical. The microplastics content was determined in supernatant fraction, in the bulk of the extraction solution, in spoil dump fraction of MPSS and in instrument wash-out.

While the extraction efficiency from natural sediments of ARPs by the MPSS was really high (100% in most cases), the extraction efficiency of marine microplastics was up to 10 times lower than that obtained with modified NOAA method for the same samples. Less than 40% of the total marine microplastics content has been successfully extracted with the MPSS. Large amounts of marine microplastics were found in the spoil dump and in the bulk solution fractions of the MPSS. Changes in stirring and separation periods had weak impact on the extraction efficiency of ARPs and marine microplastics. Until now, we are unable to find effective working procedures for adequate extraction of marine microplastics with the MPSS.

The MPSS was found to be a useful tool for microplastics extraction from large sediment samples for qualitative analysis and to obtain examination specimens. Applying the MPSS for quantitative microplastics analysis requires further testing and elaboration of standardized extraction procedures.
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Imhof, H. K., Schmid, J., Niessner, R., Ivleva, N. P., Laforsch, C. 2012. A novel, highly efficient method for the separation and quantification of plastic particles in sediments of aquatic environments. Limnology and Oceanography: Methods, 10(7), 524-537. DOI 10.4319/lom.2012.10.524