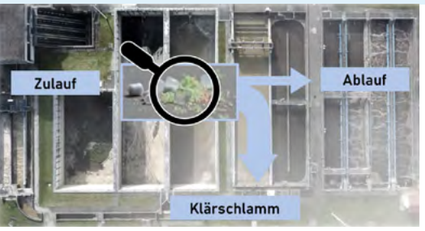
An Initiative of the German Federal Ministry of Education and Research

Plastics in the **Environment**

sources · sinks · solutions

Microplastics in wastewater treatment

Development of sampling and analysis methods for detection of input quantities into surface waters



During wastewater treatment, microplastics are retained and accumulate in the sewage sludge. Appropriate disposal of the sewage sludge can reduce microplastic inputs into the environment.

Photo: © Institute of Hydroscience, University of the Federal Armed Forces Munich

„Wastewater treatment plants retain most of microplastic particles. Nevertheless, inputs into wastewater should be reduced by proper disposal of plastic products.“

Natalie Wick,
University of the Federal Armed Forces Munich

It is not easy to determine how much microplastic is contained in wastewater and sewage sludge. In addition to plastic, countless other particles and substances are present. To reliably determine the concentration of microplastic particles, complex procedures for sampling as well as for removal of foreign substances and analysis of the microplastic particles are required.

To ensure comparable analysis results, standardized methods are indispensable

Different methods are available for sampling, sample preparation and analysis. Optimization and harmonization of the methods is necessary to obtain reliable and comparable results. These can then be used to generate a large database for the determination of microplastic inputs into water bodies. It must be ensured that the sample taken is representative of the respective sub-stream (wastewater or sewage sludge). During processing, the surrounding substances (matrix) must be completely separated without microplastic particles becoming lost or damaged. Spectroscopic analysis methods have to be able to reliably identify plastic and distinguish it from other particles. Since microplastics are ubiquitous, it is important to prevent contamination of the sample during all steps of the sample analysis.

Challenges in identifying microplastic inputs to surface waters

Various challenges must be overcome during the investigation of microplastics in wastewater and sewage sludge:

A stainless steel filter cascade is suitable for concentrating a large sample volume.

Photo: © Natalie Wick 2019

- For samples with low particle contents, a very large sample volume is required
- Significant pressure loss during filtration
- Extraneous inputs of microplastics from unknown sources can falsify results
- The behavior of the plastics can differ due to their respective physical properties
- Analyses may sometimes take several days

Research on microplastic retention by wastewater treatment plants

The PLASTRAT project focuses on the quantification and technical reduction potential of plastic emissions in the field of urban water management, including sewage sludge treatment.
The exemplary application of optimized and adapted sampling, preparation and analysis methods has confirmed their suitability and shown that 99 % of the microplastic in the wastewater can be retained in the investigated wastewater treatment plant (measurement of particles > 50 µm). This accumulates in the sewage sludge. Microplastic inputs into the environment can be reduced by appropriate disposal of the sewage sludge (PLASTRAT, 2021).

Existing testing methods must be adapted for wastewater treatment plants

The methods currently used to analyze microplastics in water mainly originate from the field of marine research. The methods must be adapted for wastewater analysis in sewage treatment plants. Here, 24 hour sampling with subsequent filtration and/or sample preparation to remove the organic components are suitable. An automated analysis with a combination of optical particle detection and Raman microspectroscopy can provide results on particle number, type, shape and color.

Despite elaborate preparation of the sample, numerous plastic and non-plastic particles are ultimately still present on the measuring filter.

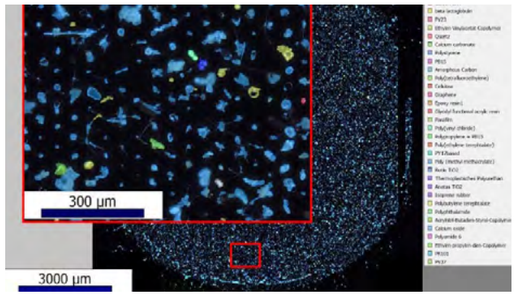


Photo: © IPF Dresden 2019

The particles in the sample are initially concentrated. The microplastics must then be separated out.

Photo: © Natalie Wick 2019

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Status
March 2021

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This fact sheet was prepared as part of the research focus „Plasticsin the Environment“ (duration 2017-2022), funded by the German Federal Ministry of Education and Research (BMBF). The authors are solely responsible for the contents of the fact sheet. They do not reflect the official opinion of the BMBF.

Wick, Natalie; Krause, Steffen; Schaum, Christian; Fischer, Franziska; Fischer, Dieter; Klaeger, Franziska; Ivar do Sul, Juliana; Labrenz, Matthias (2020): Microplastics in wastewater treatment: Development of sampling and analysis methods for detection of input quantities into surface waters. Fact sheet 11 of the BMBF research focus „Plastics in the Environment“.

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