

# Development of Standard Operating Procedures for Sampling of Microplastic in Waste Water Treatment Plants

Gerold Bönisch and André Lerch

## Motivation & Objectives

- Microplastic (MP) gained more and more interest of the public and scientific communities with focus on:
  1. the occurrence in freshwater systems
  2. the behaviour in technical systems, e.g. waste water treatment plants (WWTPs)
- Few studies on MP in WWTPs were published (see table 1), thereby
  1. results differ
  2. mainly focused on WWTP effluent
  3. sampling procedures often remain unclear and lack of confirmability
  4. sample number, size, volume and method vary
  5. particle sizes determined by screens of different mesh sizes, delivering often just coarse subdivisions but no real distributions

Need to establish standard operating procedures (SOP) for sampling and analytics :

1. to compare the results of different studies
2. to perform mass balances (with possible sources and sinks) within the WWTPs

Table 1: Sampling volumes and methods used in studies on the occurrence of Microplastic in waste water treatment plants (examples of studies)

Author	Sampling Volume		Sampling Method		
	Influent	Effluent	24-hour mixed sample	grab sample	2- and 6-hour mixed sample
Leslie et al. (2012)		not specified		X	
Brandsma et al. (2013)	2 L	2 L	X		
Chaskey et al. (2014)		not specified			X
HELCOM (2014)	0,1 L	1 L <sup>+</sup> 50 L <sup>++</sup>	X		
Magnusson (2014)	0,7 to 2,5 L <sup>+</sup> 0,25 to 0,5 L <sup>++</sup>	37 to 230 L <sup>+</sup> 2 to 18 L <sup>++</sup>	X	X	
Magnusson and Wahlberg (2014)	1 to 8 L <sup>+</sup> 1 to 5 L <sup>++</sup>	800 to 1,000 L <sup>+</sup> 4 to 9 L <sup>++</sup>		X	
van Echelpoel (2014)	7 L	7 L	X	X	
Universität Bayreuth (2015)		255 to 517 L		X	

<sup>+</sup> particle size < 300 to 100 µm  
<sup>++</sup> particle size < 100 to 20 µm

<sup>+</sup> particle size ≥ 300 µm  
<sup>++</sup> particle size < 300 to 20 µm

## Approaches and first Results

### Approaches

- Testing different set-ups (e.g. pumps, screens) for sampling on various points within the WWTP by use of local on-site equipment of the WWTP and authorities
- Assessment of the MP release by the different set-ups itself
- Assessment of the recovery of the sampling method (see Figure 1)
  - defined particle concentrations added to a tank, sampling of an 24-hour mixed samples and measurement of the particle number

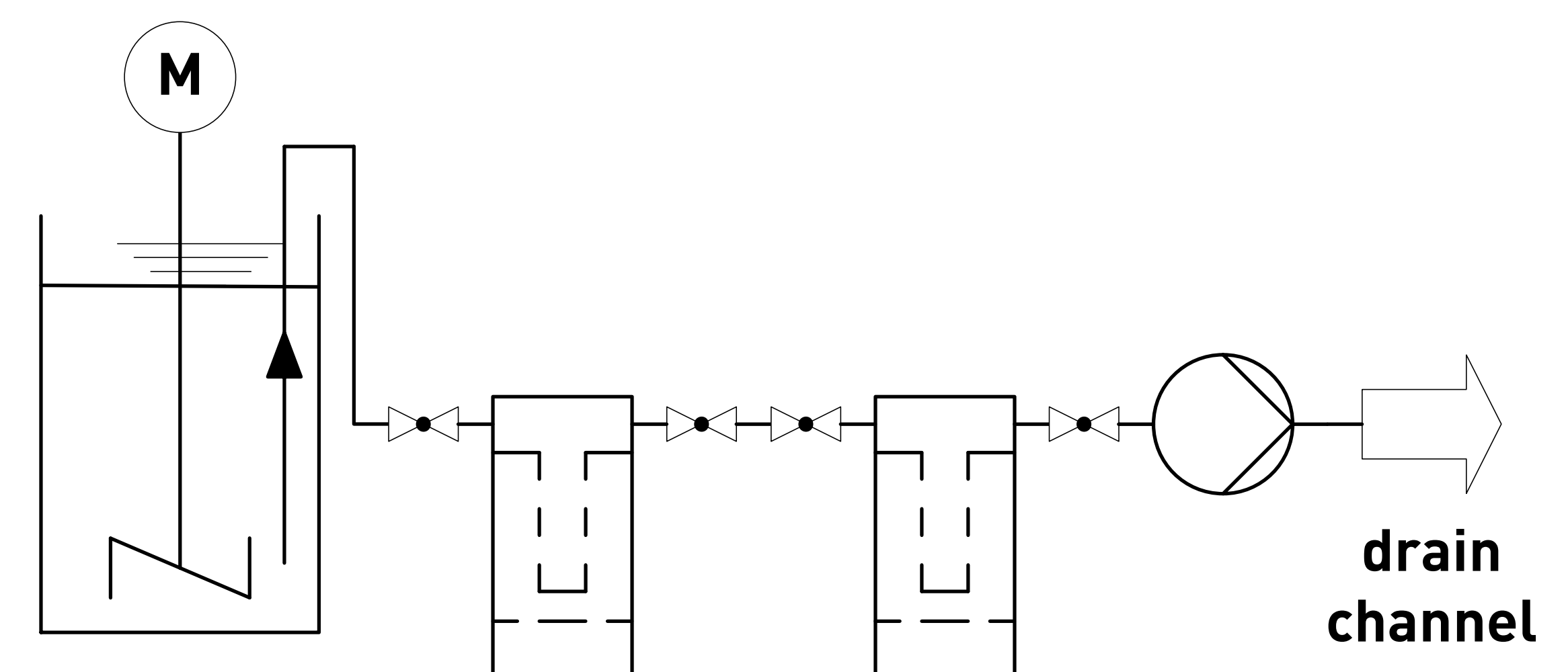


Figure 1: Example of the sampling set-up used to assess the recovery of the sampling method

Results for sampling with a peristaltic pump by using polypropylene tube

- increase of the particles number in the range of 2 to 139 µm within the 1<sup>st</sup> day of the test (see Figure 2) → the particle material is unknown
- no further significant increase of the particles number after the 1<sup>st</sup> day (see Figure 2)
- BUT: insert of visible plastic particles from the polypropylene tube (see Figure 3)

### Acknowledgments

Parts of the material shown is based on the work of Saphira Schnaut and Stephan Pieper within their bachelor and master thesis.

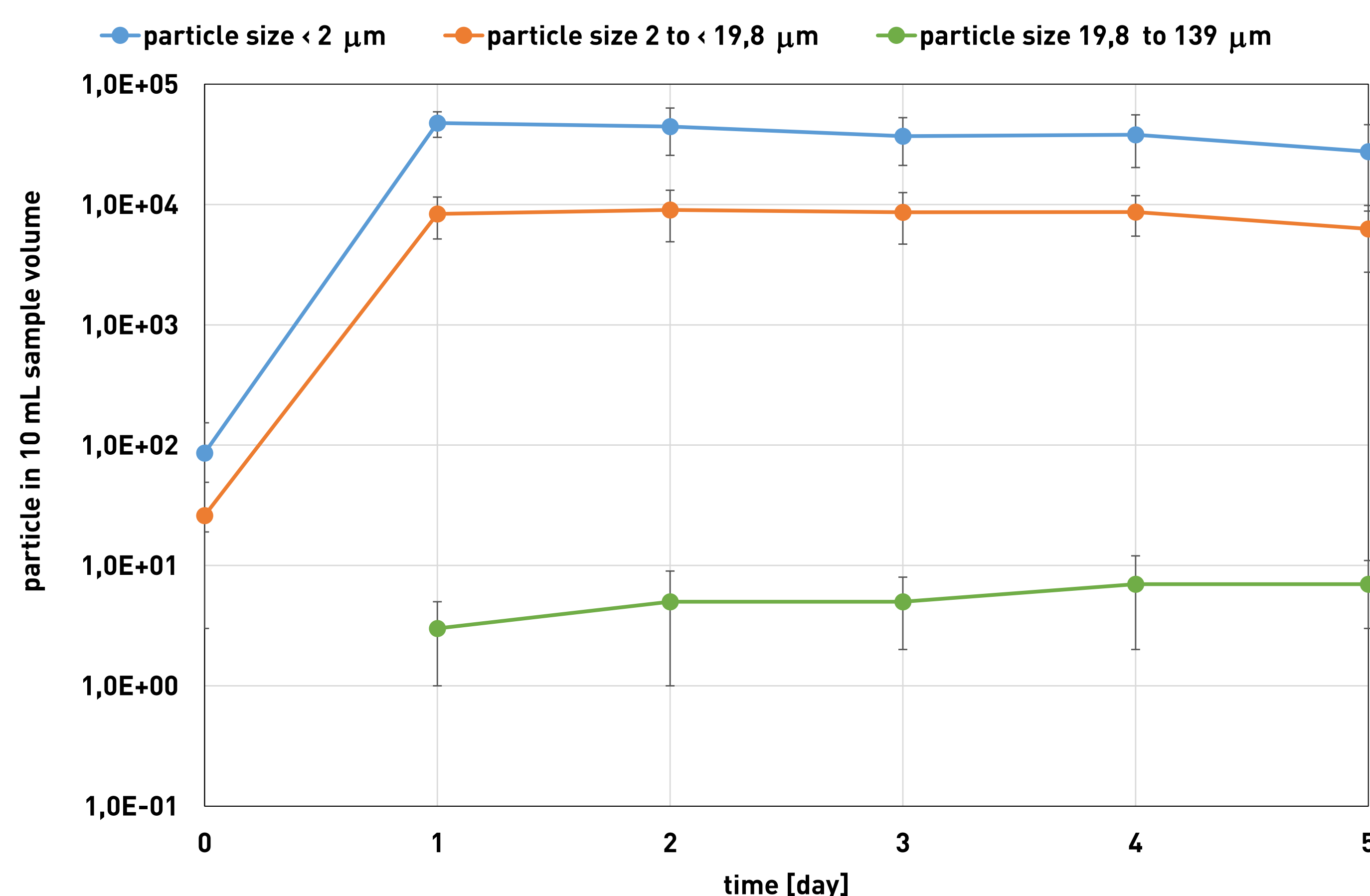


Figure 2: Development of the particles vs. time

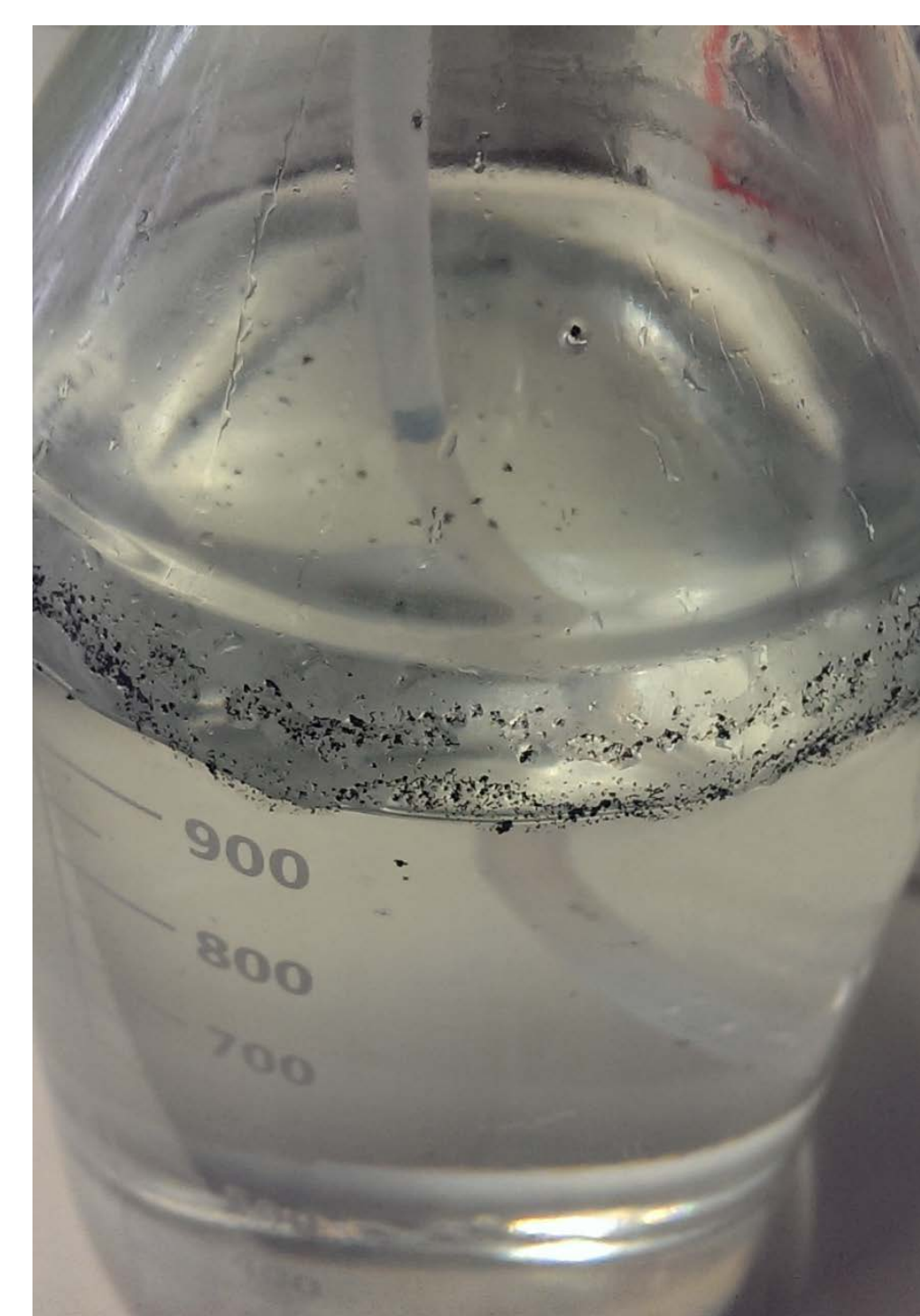
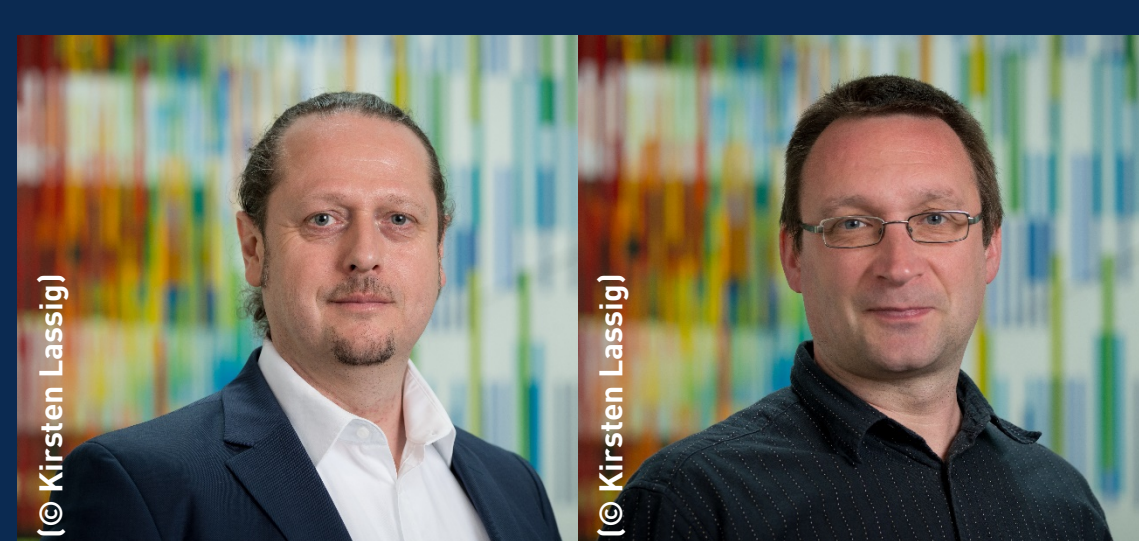


Figure 3: Inserted plastic particles by using a hose pump (© Stephan Pieper)



Contact: Dr.-Ing. André Lerch  
E-Mail: andre.lerch@tu-dresden.de

Dipl.-Ing. Gerold Bönisch  
E-Mail: gerold.boenisch@tu-dresden.de

Technische Universität Dresden  
Institute of Urban and Industrial Water Management  
Chair of Hydro Process Engineering  
01062 Dresden  
Tel.: +49 351 463-32337