Federal Ministry of Education and Research

FONA Research for Sustainable Development BMBF

SubµTrack – Tracking Down Smallest Plastic Particles

Plastics in the Environment – Sources • Sinks • Solutions

Microplastics in the environment are an issue whose extent and effects have not yet been sufficiently investigated. Current analytical methods make it possible to detect particles in the size range up to one micrometer (µm), i.e. one thousandth of a millimeter. Even smaller, so-called submicroparticles, were scarcely researched to date. Due to their properties, these submicroparticles are potentially even more harmful to humans and the environment than larger plastic particles. The project partners of the joint research project SubµTrack are developing new methods of analysis and evaluation, which will allow for assessment and toxicological investigations of plastic particles of different sizes.

Potential Risks of Submicroparticles

Microplastic particles reach the environment either directly or through the disintegration of plastic waste (primary and secondary microplastics). Previous investigations have predominantly dealt with microplastics between 1 µm and 5 mm. However, the effects of even smaller particles, especially in the range below 100 µm, are currently discussed. These may be cell permeable - i.e. able to penetrate cell walls - and can potentially bind more pollutants due to their relatively larger surface area. A new source for such submicroplastics is, for example, 3D printers, which are growing in popularity. Due to inadequate analytical methods and a lack of toxicological data, it is currently not possible to evaluate submicroparticles regarding their emission, fate, degradation and potential environmental effects.

Environmental Problems and Societal Challenges

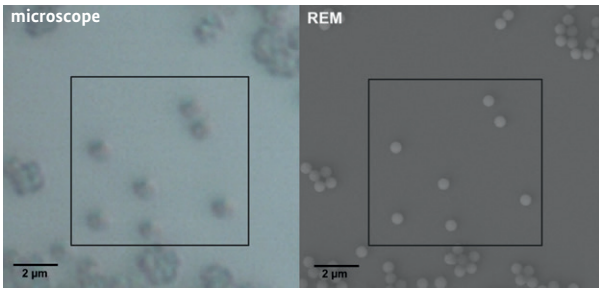
The joint research project SubµTrack specifically investigates the range of particles in the nano- as well as lower and middle micrometer range between 50 nm and 100 µm, which have hardly been defined previously. The researchers are pursuing a networked approach. On the one hand, they look at microplastics as an environmental problem and at the same time explore it as a societal challenge.

The project is divided into three main areas. The partners from science, research, public authorities and industry want to develop technologies that make it possible to reliably analyze submicroplastics.

This includes the adaptation of existing methods as well as the development of new ones for sampling, processing, and for analysis. The newly developed methods will be validated on reference particles in the laboratory, in laboratory wastewater treatment plants and in environmental samples.

Another focus is the possible effects of submicroplastic particles on water bodies and human health. To this end, the researchers are investigating the uptake of the particles and their physiological effect on aquatic organisms and cell cultures.

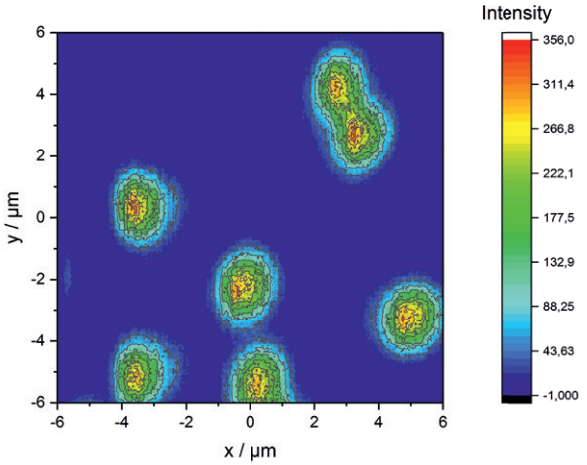
Thirdly, social, political and legal aspects will be considered. The project participants explore to what extent (sub)microplastic particles are perceived by society as a problem and explore the necessities for new legal measures.



Polystyrene particles (Ø 500 nm) in a light microscope (left) and in a scanning electron microscope (right)

Strategies for Submicroplastics

The results of the project should lay the foundation for a comprehensive analysis of submicroparticles. The methods developed are coordinated with those from other ongoing projects. This forms the basis for a meaningful risk assessment of smallest plastic particles. Taking social and political aspects into account, researchers can use risk assessment to develop strategies for action on submicroplastics and thus create the framework conditions for possible processes of societal change. In addition, the research results obtained will contribute to the further development of legal regulations and help close existing regulatory gaps.



Raman particle map: The type of polymer – in this case polystyrene – can be determined using a Raman microspectrometer.

Research Focus
Plastics in the Environment – Sources • Sinks • Solutions

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