

HORIBA



Solutions For Microplastics Analyses

www.horiba.com/microplastics



Microplastics: A Challenge for Society

Why Should We Care?

What Are Microplastics?

Any solid plastic or synthetic polymer particle that is insoluble in water, with the largest dimension between 1 µm and 5 mm.



Synthetic Textiles



Paints



Plastic Pellets



Plastic Waste

Microplastics Are Everywhere

They originate from a variety of sources, both primary (directly released into the environment in their small form) and secondary (resulting from the breakdown of larger plastic debris).



Exfoliating Personal Care Products and Toothpastes



Tyres

Our world is full of particles like dust, pollen, and soot that people breathe in daily. The challenge is to understand how much plastic adds to this particle load and does it have a harmful effect?

Microplastics Are Persistent in Ecosystems*

They accumulate in the environment and can end up in humans through the food chain and/or air exposure. Microplastics have been detected in human heart tissues and in placentas, proving that they can circulate throughout the body.

Are Microplastics Dangerous?

The potential harmful effects of microplastics on humans are an area of ongoing research. Several studies suggest possible health risks. Microplastics might cause inflammation due to excessive accumulation in the gastrointestinal tract or respiratory systems. They can carry harmful chemicals, including endocrine disruptors, heavy metals, or even carcinogens.

More Research Is Needed

We need to determine the levels of exposure that may be harmful, the mechanisms by which microplastics may cause harm, and the long-term health effects of microplastic exposure.

Towards Microplastics Monitoring: Be Prepared for Tomorrow...

Governments take seriously the concerns related to microplastics. As the scientific community continues to investigate the potential risks, **some actions have been already taken:**

To Reduce the Microplastics Pollution



Bans and Restrictions on Single-Use Plastics

Over 60 countries have adopted various forms of bans and restrictions on single-use plastics. These measures range from complete bans on items like plastic bags, straws, and cutlery, to partial restrictions and levies aimed at reducing plastic waste.



Ban on Intentionally Added Microplastics

Around 15 to 20 countries have implemented bans on intentionally added microplastics, such as microbeads in cosmetics and personal care products.



Preventing Plastic Pellet Losses

Proposal for a regulation of the European Parliament and of the Council (2023)

To Harmonize Microplastics Analysis



Principles for the Analysis of Microplastics Present in the Environment

ISO 24187:2023



Textiles and Textile Products: Microplastics from Textile Sources

ISO 4484-2:2023



Water quality: Analysis of Microplastic in Water

ISO/DIS 16094-2 (expected in 2024)

HORIBA is honoured to be included in several technical groups developing these standards

To Monitor Microplastics



In Europe, The Marine Strategy Framework Directive has initiated monitoring along coastlines, on the surface of the sea, and in seabed sediment.

The Drinking Water Directive, Groundwater Directive, and the Environmental Quality Standards Directive establish a legislative foundation for future systematic microplastics monitoring under the overall Water Framework Directive.

The proposed revisions to the Urban Wastewater Treatment Directive include the implementation of monitoring at the inlets and outlets of urban wastewater treatment plants and in sludge.

In the USA, California has been a leader in this area, passing legislation to study and address microplastic pollution in drinking water and the marine environment. Various federal agencies, including the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA), conduct research and monitoring related to microplastics. These efforts can provide insight into future regulations and strategies for addressing microplastic pollution.

Microplastics Analysis: How and Why?

To better understand the toxicological effects of microplastics and the mechanisms by which they may cause harm, the following properties should be characterized:

- Chemical composition
- Particles number
- Particles dimensions (diameter, area, etc.)
- Particles morphology

Vibrational micro-spectroscopy is the reference method to perform such analysis.

HORIBA recommends **Raman Microscopy** for analysis of the particles **down to 1 micron**.

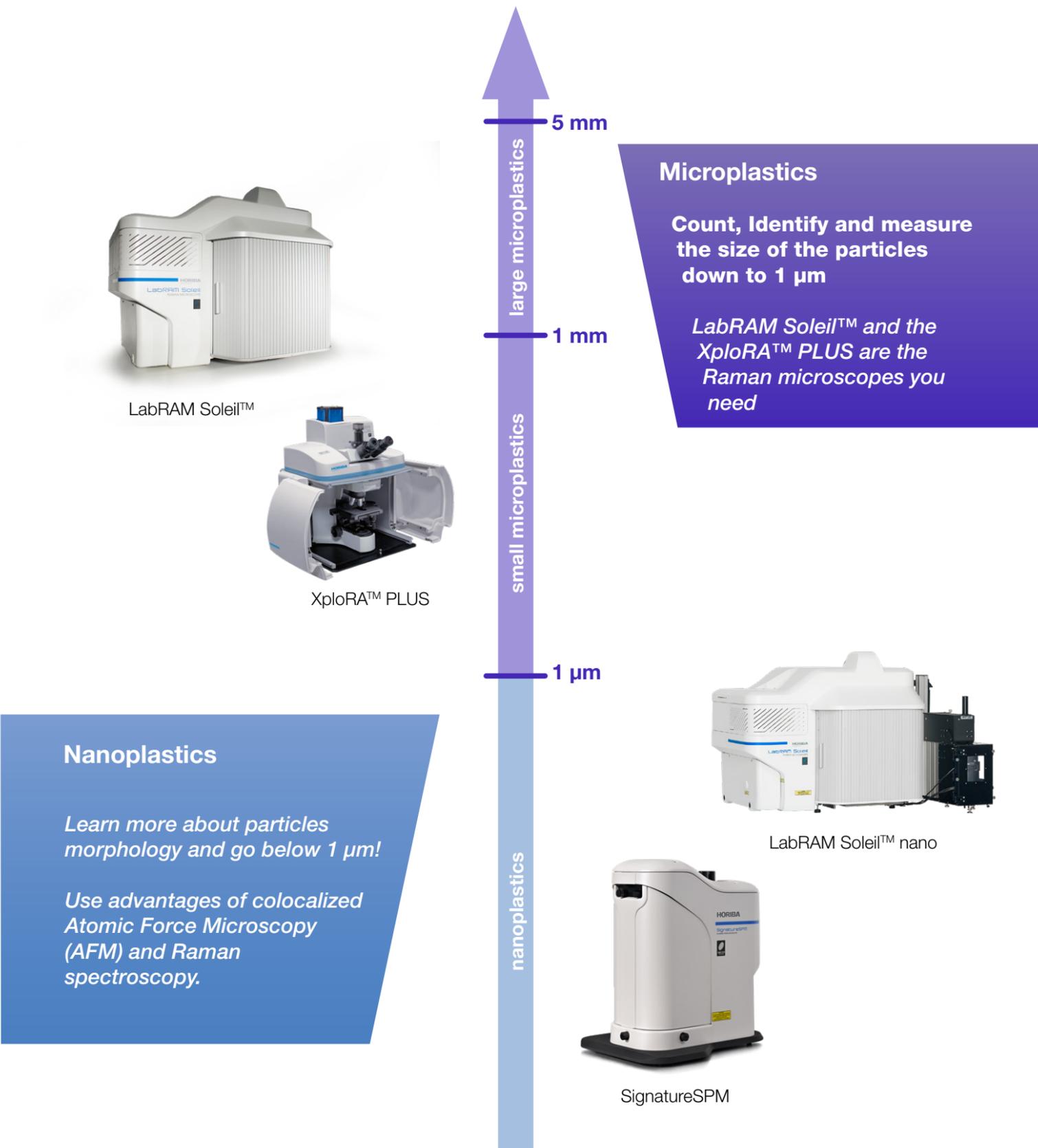
From Sampling to Data Reporting

Typical Workflow for Microplastics Analysis



| Sampling | Pre-Treatment | Filtration | Data Acquisition | Data Analysis & Reporting |
|--|--|---|--|---|
| Collection of a matrix where the presence of microplastics will be investigated. | This step might be needed to isolate microplastics from the matrix. It could include size fractionation, density separation, extraction and/or chemical digestion. | Microplastics particles are collected on filters for spectroscopic analysis. Filters must be carefully chosen based on expected size and quantity, and compatibility with the chosen spectroscopic technique. | HORIBA recommends Raman Microscopy which allows the identification of organic and inorganic particles and assures the analysis of particles from 1 μm to 5 mm (sub-micron also feasible). | Software is a key for efficient data manipulation and for optimal presentation of results. HORIBA provides fully automated, easy-to-use particle analysis software: ParticleFinder™ and IDFinder. |

Boost your research with HORIBA instruments



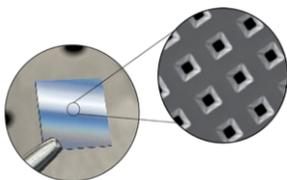
HORIBA Solution for Microplastics Analysis

Sample Preparation: Filtration kit



Filtration Apparatus

Adapted for different kinds of filters, and assures high recovery rate of particles



Silicon Filters

- Pore sizes down to 1 micron are available
- Flat and reflective surface - ideal for automatic particles location
- No spectral interferences of filter material with microplastics



Filter Holder

Adapted for Si square filters, 10x10 mm



LabRAM Soleil™



XploRA™ PLUS

Sample Analysis: Raman Microscope and Software



LabSpec software provides complete instrument control and data processing. This package also includes the applications needed for efficient microplastics analysis.

Method Validation: QC Tools and Reference Materials

To validate the whole analytical workflow: A set of soluble tablets containing a known quantity of polymer particles of known size.



VRM (Video Raman Matching) with NanoGPS technology to confidently locate even the smallest particles.



Learn More: Microplastics Booklet

Provides an overview of the microplastics world to fill any gaps in your knowledge.

- Explains and details the protocols for sample preparation
- Summarizes the measurement techniques available and their pros and cons
- Understand the tricks and tips of microplastic analysis

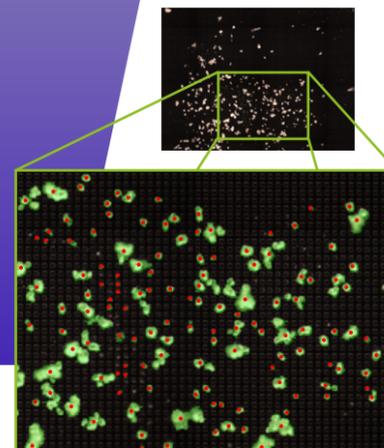
Automatic Analysis of Particles



ParticleFinder™, a user-friendly tool for automated particle location, counting, size and shape characterization, and Raman analysis of thousands of particles.

With ParticleFinder

No need to scan the total surface of the filter, only particles are analyzed



- Automatic localization of particles
- Automatic recording of spectra for each particle
- Able to select the particles for Raman analysis based on their size, shape or statistical approach

IDFinder allows instant particle-by-particle spectral identification directly in LabSpec.

IDFinder enables the effortless creation and management of libraries, and identification of spectra. Experience the freedom of a permanent license and ensure continuous access to your custom libraries for all your applications.

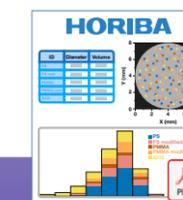


With IDFinder

Identify multiple spectra automatically

| Image | Spectrum | Class | HQI |
|-------|----------|----------------|-------|
| | | Poly(ethylene) | 68.77 |
| | | Poly(ethylene) | 95.64 |
| | | Poly(ethylene) | 91.15 |
| | | Poly(ethylene) | 82.36 |
| | | Poly(ethylene) | 77.21 |
| | | Polypropyl... | 85.34 |
| | | Polypropyl... | 71.38 |
| | | Polypropyl... | 84.40 |
| | | Polypropyl... | 94.49 |
| | | Poly(ethylene) | 88.20 |
| | | Poly(ethylene) | 83.25 |
| | | Poly(ethylene) | 73.77 |
| | | Poly(ethylene) | 91.22 |
| | | Poly(ethylene) | 65.08 |
| | | Poly(ethylene) | 79.82 |
| | | Poly(ethylene) | 75.03 |
| | | Poly(ethylene) | 74.01 |
| | | Poly(ethylene) | 75.51 |
| | | Cotton | 79.25 |
| | | | 80.63 |
| | | | 7.12 |
| | | | 79.44 |

Particles' coordinates, dimensions, shape, colour, spectrum and chemical ID... all information is summarized in one table.



Customize your report and generate it in one click!

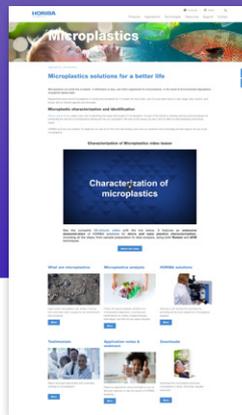
More about HORIBA

The HORIBA Group, made up of 49 companies in 27 countries, is a leading company that provides **analytical and measurement systems** throughout the world. HORIBA's business is evolving in the markets of automotive, process and environmental instruments, medical diagnostics, semiconductor instruments and scientific instruments. It is our continual source of joy and pride that our analytical and measurement business can contribute to **global environmental conservation, safety and health, and moreover to improving energy problems.**

Omoshiro-okashiku
Joy and Fun



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