HORIBA
Scientific

The Microplastics Solutions

For a better life

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Technology

Microplastics, a Challenge for Society

Why should we care?

What are microplastics?

'Microplastic' means a material consisting of solid polymer-containing particles, to which additives or other substances may have been added, and where ≥ 1% w/w of particles have

- all dimensions 1nm ≤ x ≤ 5mm,
- or, for fibres, a length of 3nm ≤ x ≤ 15mm and length to diameter ratio of >3.

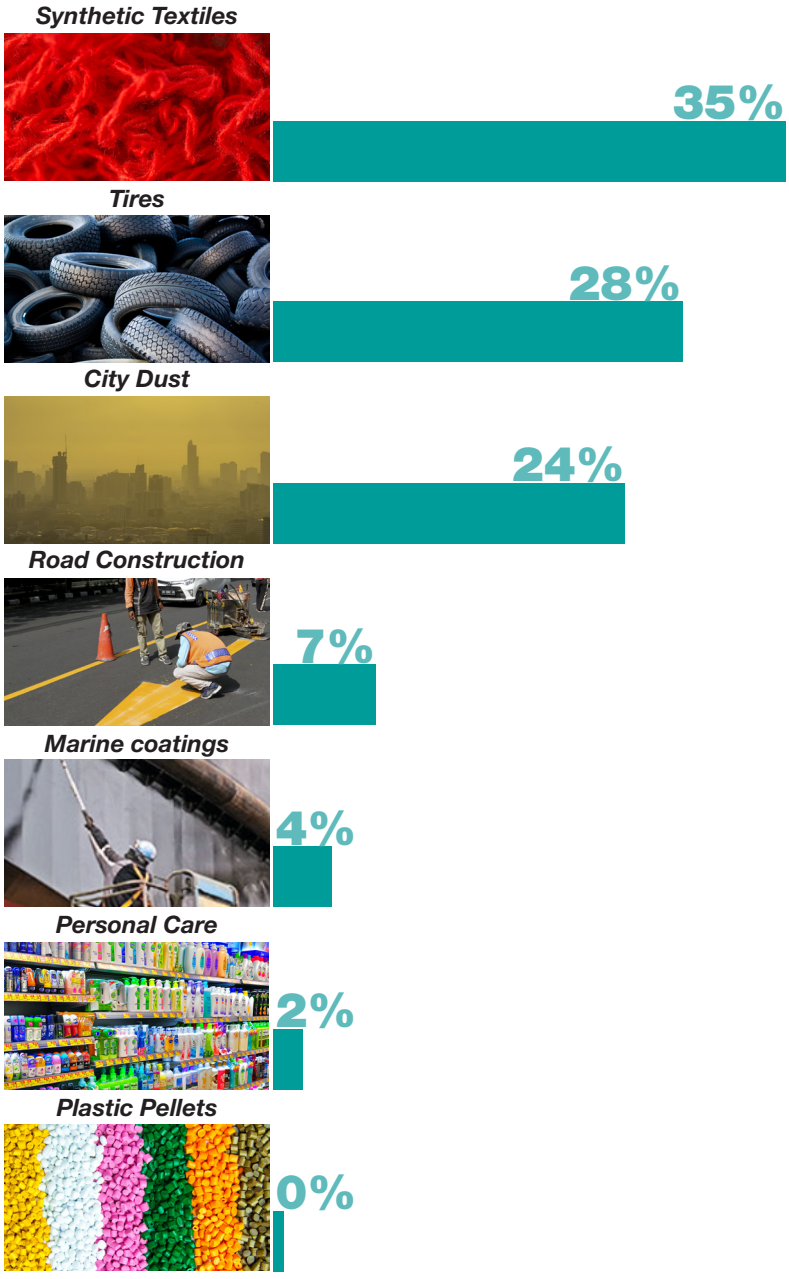
Microplastics can be divided in two families:

Primary microplastic are directly released into the environment as small plastic bits. These are intentionally engineered particles, like those found in some consumer and industrial products. Cosmetics, for example, have used microplastics as abrasives and textiles use it for durability.

Secondary microplastic are the result of the degradation of large plastic waste, like plastic bags and bottles, into smaller plastic fragments when exposed to our environment.

The main origins of microplastics

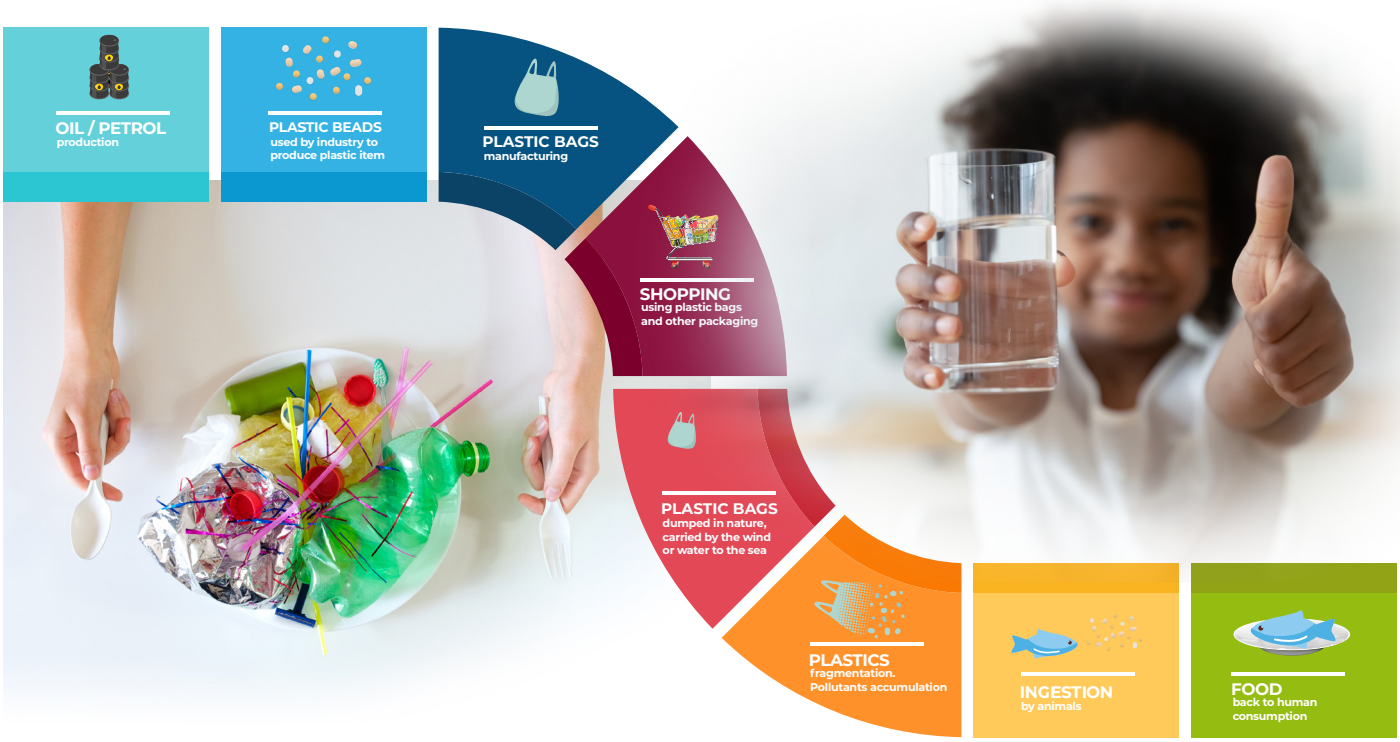
The proliferation of microplastics in the world's oceans and rivers is accelerating and no place on Earth is unaffected. In 2017, the IUCN (International Union for Conservation of Nature) has identified the main sources of microplastics. There are **seven main sources of microplastics** from the degradation of synthetic textiles, tire degradation, city dust, road construction, marine coatings, personal care products and plastic pellets.



Source : IUCN "Primary Microplastics in the Oceans: a Global Evaluation of Sources", 2017

Microplastics are toxic to living species and the environment

Microplastics are present in a very large number of living species, they have been seen in more than 500 species and are found in various foods such as salt, honey, fish, tap water and mineral water. The presence of microplastics has also been detected in the human body and even in placentas proving that they can circulate throughout the body. Although the toxicity of the presence of microplastics in humans has not yet been demonstrated, flea studies have shown behavioural effects and malformations.



A challenge for all

We all consciously or unconsciously use plastic objects, be it shopping bags, cups or even tea bags! To help us reduce our consumption, many standards have been enacted around the world, specially for plastics bags, single-use plastics and micro-beads.

The European Community has made some progress in the last few years and is due to publish a plan in 2021 which will define and regulate added microplastic particles for all types of consumer and professional use products. It is anticipated that these regulations will require the quantification of microplastics in drinking water using spectroscopic methods.

HORIBA Scientific is honoured to be included in the technical group developing this regulation.

Microplastics, from Sampling to Data Analysis

Five steps for plastics identification

A typical analysis workflow for microplastics separation, counting and identification using spectroscopic techniques requires five main steps: sampling, sample preparation or sample pre-treatment, filtration, measurement/data acquisition and finally analysis/reporting.

1. Sampling

The Sampling step involves the collection of a matrix and/or different matrices where the presence of microplastics will be investigated.

2. Sample Preparation

Sample pre-treatment is one of the most important steps since it can affect/ influence the correct identification of the microplastics during the measuring step.The contribution from the matrices (and all the organic contaminants within them) that can interfere with microplastic identification must be eliminated.

3. Filtration

Filters must be carefully selected from the wide range available on the market. Three main characteristics must be considered: Filter size (microplastic concentration, analysis time etc… drive this choice), filter material (depends on the measurement technique) and pore size (tuned by the microplastic size to be analyzed).

4. Measure/Data Acquisition

Chemical/Morphological Identification of microplastics by the technique of choice. HORIBA recommends Raman Microscopy which allows the identification of organic and inorganic particles and assure the analysis of particles from the macro (1 to 5mm), down to the micron and sub micron range.

5. Analysis & Reporting

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™.

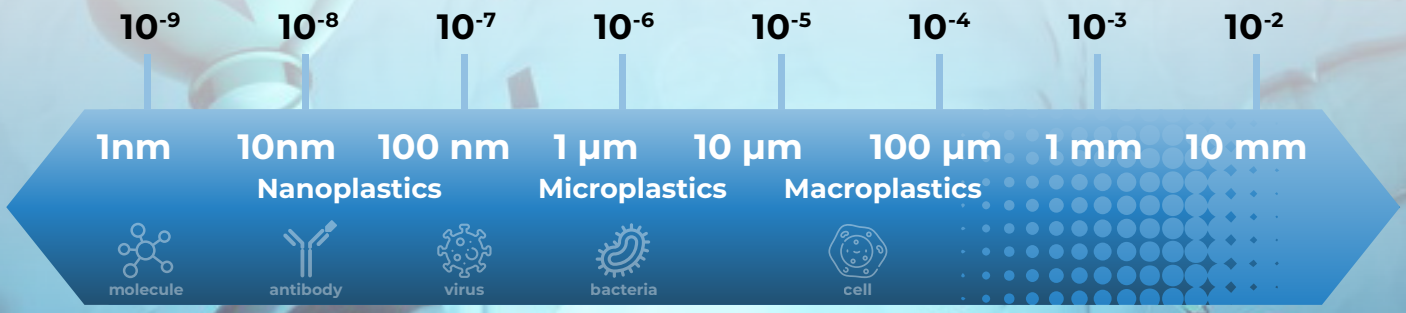
What size microplastics are you searching for?

The HORIBA Raman portfolio allows you selection of the best solution that fits your needs and challenges.

Do you want to analyze macro-particles down to 200 microns?
Our benchtop MacroRAM™ with its compact and robust design is the perfect solution. It has several accessories available, such as a fiber probe for quick and reliable remote sensing.

Do you need to reach submicron resolution?
The LabRAM Soleil™ and the XploRA™ PLUS are the Raman microscopes you need.

Are you interested in Nanoplatics?
The combination of Atomic Force Microscopy and Raman Microscopes is your solution. Exploit the co-localized AFM-Raman analysis to go beyond the spatial resolution of Raman with Tip Enhanced Raman Spectroscopy to reach few tens of nanometers.



A Microplastics Package
to help your daily lab work

After careful consideration of the optimal microplastic analysis workflow and the needs and challenges of the people approaching this topic HORIBA have developed a full solution to assist our existing and future customers by providing:

Booklet

A Booklet to:

- Provide you an overview of the microplastics world to fill any gaps in your knowledge
- Explain and detail the protocols for sample preparation
- Summarize the measurement techniques available and their Pros and Cons
- Understand the tricks and tips of microplastic analysis
- Keep you updated. The booklet will be updated twice a year with new protocols, information etc…

Filtration Kit

Filtration apparatus to get your microplastic analysis started.

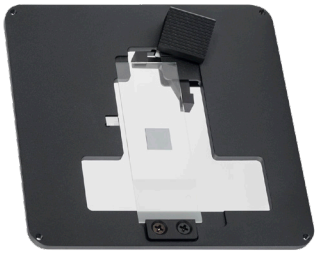
Microplastics Standard

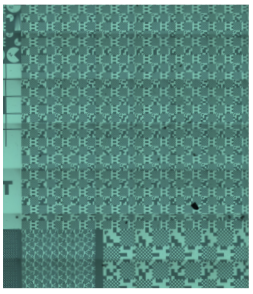
A set of tablets containing a mixture of polymer particles (PVC, …) of known size distribution and number to validate your lab environment and workflow.

Filters, Filter Holder and VRM

A box of Silicon filters with a holder specifically developed and optimized for efficient analysis of these square filters.

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





Raman platform

XploRA™ PLUS, LabRAM Soleil™. Both Raman microscopes can be equipped with either a standard detector (CCD - Charge Couple Device) or an Imaging detector (EMCCD - Electron Multiplying Charge Couple Device). The LabSpec 6 software platform is common to both systems for complete instrument control and data processing and this package also includes the apps needed for efficient microplastics analysis

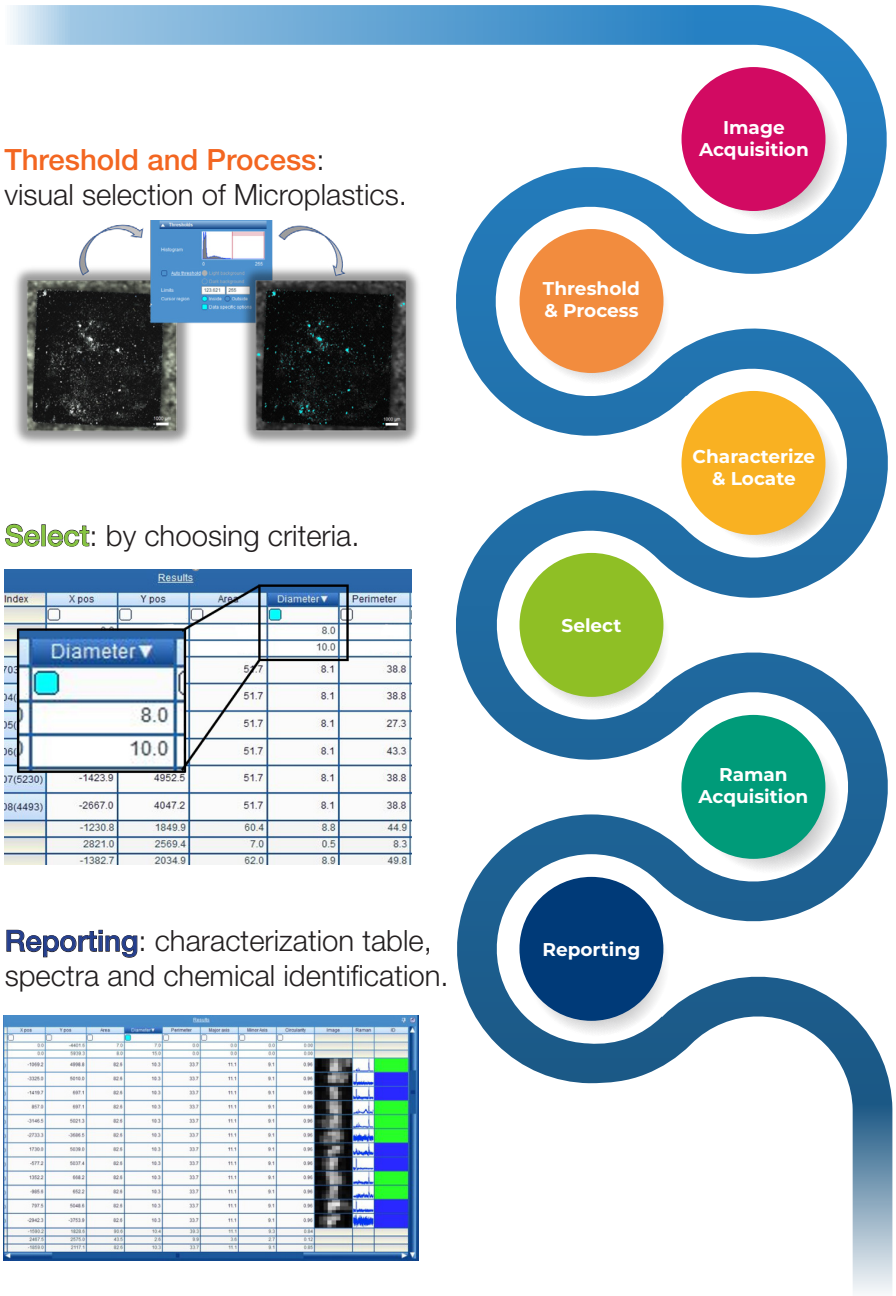
Analysis of particles using ParticleFinder™

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

Visualize ➡ Identify ➡ Analyze ➡ Report

The combination of morphological data and chemical identification on each particle provides complete and accurate characterization and classification. ParticleFinder™, together with HORIBA Raman spectrometers, enables reliable and fast microplastic characterization.

Example of Marine Water measured with the LabRAM Soleil

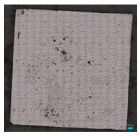


Threshold and Process: visual selection of Microplastics.

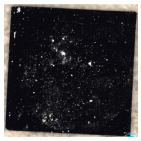
Select: by choosing criteria.

Reporting: characterization table, spectra and chemical identification.

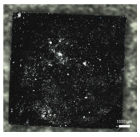
Image Acquisition: using VRM (Visual Raman Matching) coupled with NanoGPS technology provides fast and precise calibration, enabling multi-magnification Raman Imaging to optimize analysis time.



BrightField

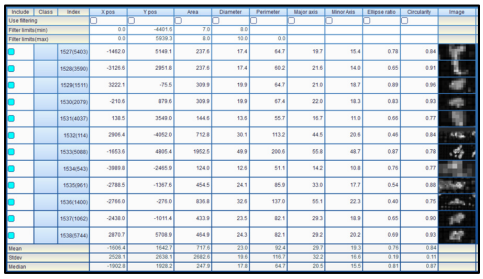


BrightField
Crossed visible Polarization

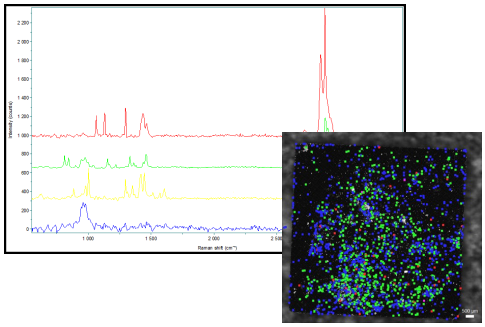


DarkField

Characterize: position, area, diameter, perimeter, axis, ratio, circularity, image.



Raman Acquisition: The chemical identification by exploiting the HORIBA polymer library to identify components.



Polypropylene [PP], High Density Polyethylene [HDPE], Polyethylene (low density) [PE] and Polytetrafluoroethylene [PET]

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