FT-IR AND RAMAN-MICROSCOPY

Microplastic Analysis

Daily used by leading microplastic scientists, worldwide.

Innovation with Integrity

What are Microplastics?

According to definition, polymer particles with a diameter of less than 5 mm are referred to as microplastic particles (MPP). Depending on their origin, they are further subdivided into primary and secondary particles.
Primary MPP are those which have been specifically produced for industrial use, while secondary MPPs are formed by physical, biological and chemical degradation of macroscopic plastics.

Why use FT-IR and Raman Micro Spectroscopy?

Microscopy is a quick and easy way to detect particles by their visual appearance. However, combined with infrared or Raman spectroscopy its effectiveness increases greatly, now including a chemical analysis. Bruker favors a comprehensive analytical approach, in which MPP must be found and identified reliably, without the chance for human error.

Why Go for Bruker?

Bruker draws upon decades of experience in vibrational spectroscopy and has been at the forefront of investigating microplastics from the very beginning. Today, we are helping scientists worldwide to better understand this global threat to our ecosystems. We provide the necessary tools and technologies to conduct failsafe and precise microplastic studies.

Infrared for MP Analysis

- Easy to use and evaluate
- Very fast analysis by imaging
- Reliable identification results
- High automation of analysis
- Analysis down to particles > 2 µm
- Universal particle analysis

Infrared for Raman Analyis

- Analysis of particles > 0.5 µm
- Highest visual image quality
- Easily distinguishes inorganics
- High automation of analysis
- High-res contact-free analysis

About Detection and Analysis of Microplastics

Approach #1:
Light Microscopy and Spectroscopy

For particles >500 µm, the combination of a standard light microscope and a powerful compact spectrometer can be a good and inexpensive solution. After the particles were detected with a microscope, they are brought to the spectrometer for chemical analysis.

Approach #2:
FT-IR and Raman Microscopy

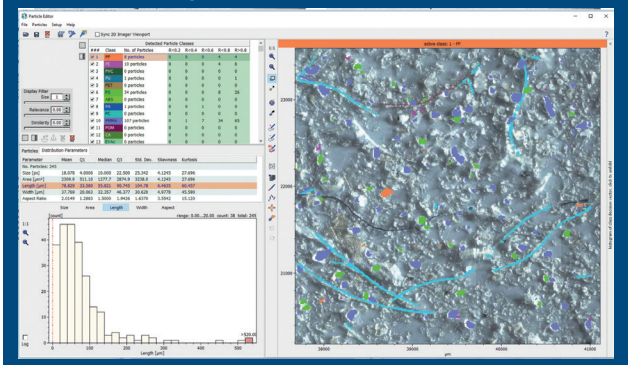
The gold standard in MPP analysis. Not only can small particles in the lower micrometer range be easily identified, but handling is also greatly improved. However, this approach poses more requirements to sample preparations (see below).

Approach #3:
FT-IR and Raman Imaging

The use of FT-IR or Raman imaging in microscopy offers huge benefits. In this case particles are no longer identified by optical means, but by using chemical contrast only. Especially for high concentrations of microplastics, this speeds up analysis and reduces human error significantly.

Automation is Essential

The reason for automating microplastic analysis goes beyond saving time or avoiding human error. With the goal of finding an optimal solution, Bruker partnered with Purency to offer a new, robust and comparable identification software based on **machine learning.**



With the **Purency Microplastics Finder** there is no trade-off between fast analysis and analytical quality. Its superiority comes from the method itself, which is based on enormous amounts of real-life microplastics data.

Imagine it like this: Instead of using a small, local database, you'll utilize vast amounts of **representative data** compiled by microplastics experts around the world.

At the click of a button, all relevant microplastics are analyzed:

- 20 polymers (covering 99% of current microplastics)

Within minutes, it provides a full list of found particles, their identity, size, quantity and spatial distribution across the filter. In short, this software makes your analysis more robust and the results more precise and reliable. All while being faster. **A lot faster.**

Sample Preparation

Getting Started

Combining microscopy and FT-IR or Raman spectroscopy into a single device is the logical step forward. But depending on the spectroscopic technique there are some requirements to sample preparation.

Density Separation

Depending on sample type, undesired material like wood, sand or seaweed must be removed to acquire meaningful data. For this so-called density separation, salt solutions of various concentrations are used. However, in the case of drinking water, usually only filtration is needed.

Enzymatic / Oxidative Breakdown

If you are analyzing sea water, soil or other samples containing environmental matrices, enzymatic digestion and/or treatment with H_2O_2 prior to sample filtration is often necessary to remove the excess of organic and biological contaminants.

Filter Choice

For this filtration, Raman and infrared analysis require special filters, such as aluminum oxide, silicone, gold-coated polycarbonate filters or also Teflon (PTFE) membranes or metal mesh. Fortunately, Bruker provides a special microplastic filtration kit including a pack of filters, that gets your analysis started right away with the basic tools.

Microplastic Sampling Kit (PN A165-MP) consisting a set of a complete filtration equipment and aluminium oxide filters.

Raman or Infrared Spectroscopy?

Bruker instruments are used around the world in analyzing microplastics and the threat they pose to our environment. Frequently, customers ask us –
should I prefer FT-IR or Raman?

Although the answer is not always easy, FT-IR imaging clearly has the speed advantage, while Raman imaging also detects particles smaller than 5 µm and even down to the nanometer range.

Ultrafast FT-IR Imaging Microscope: The LUMOS II

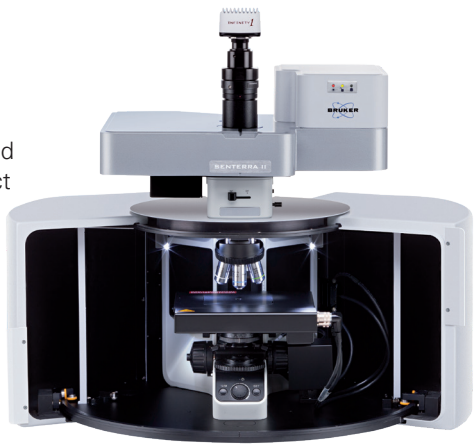
In MP analysis by µ-FT-IR, two approaches are most common. Either particles on a filter are visually identified and analyzed point by point or the complete filter is measured by imaging and investigated by chemical contrast only. For both approaches the LUMOS II offers:

- High spectral quality and resolution
- Brilliant visual images and huge field of view
- Fast imaging by focal-plane array detector
- Fully automated measurements
- MP evaluation routines and statistics

Raman Microscope and Imaging: The SENTERRA II

By far the biggest advantage of Raman microscopy is the high spatial resolution that can be achieved with a Raman microscope. While infrared measurements may miss particles smaller than 5 µm, Raman can detect and identify particles of >=1 µm. The SENTERRA II supports you with:

- Research-grade performance
- Full spectral range with all gratings
- FT-Raman technology for fluorescence mitigation
- Fully automated measurements
- MP evaluation routines and statistics



ALPHA II FT-IR spectrometer and BRAVO Handheld Raman spectrometer

Compact FT-IR Spectroscopy: ALPHA II

The ALPHA II is a compact FT-IR spectrometer with a footprint the size of a laptop. It features a robust, rugged design, offers an optional touchscreen PC, maintenance-free operation and is easily moved between operation sites.

Handheld Raman Spectroscopy: BRAVO

As a complementary technique, handheld Raman spectroscopy is a valuable asset for microplastics analysis. With compact, battery powered Raman instruments like the BRAVO, utmost flexibility is given for sample analysis.

Our Microplastic Solution Portfolio

Analytical Method	Minimum Particle Size	Filter Requirements	Degree of Automation	Acquisition Speed	Compared Cost	Bruker Instrument
ATR FT-IR Spectroscopy	> 500 µm	not applicable	low	slow	€	ALPHA II INVENIO S
FT-IR Microscopy	> 10 µm	IR transparent	high	fast	€€	LUMOS II HYPERION II
ATR FT-IR Microscopy	> 5 µm	any filter any substrate	high	medium	€€	LUMOS II HYPERION II
FT-IR Imaging	> 5 µm	IR transparent	very high	very fast	€€€	LUMOS II HYPERION II
ATR FT-IR Imaging	> 2 µm	any filter any substrate	high	medium	€€	LUMOS II HYPERION II
Raman Imaging	> 0.5 µm	non fluorescent	very high	fast	€€€	SENTERRA II

New to Microplastics Analysis?

We believe that one must first get an overview before deciding on the technology. Microplastics analysis must be effective, reliable and sustainable.

This is exactly why we think that the most crucial factor in achieving these goals is communication between instrument supplier and user. Our MP experts are looking forward to learn about your specific requirements and will try to address your problems head-on.

Together, we'll find a solution to this global environmental threat.

Our References? Globally Available.

Our instrumentation has been used by pioneers at the forefront of microplastic research for almost a decade.

The experience we gathered resulted in close collaboration and led to even better, more precise instruments.

Our portfolio is not just based on theory, but has been shaped and proven in practice.

What our Customers Say:

In our new microplastic keylab many researchers with various scientific backgrounds will be using the same instrument. Therefore, its operation must be simple, the device robust and the results quickly available. That's why we've chosen the LUMOS II from Bruker.

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Bruker Optics is ISO 9001, ISO 13485, ISO 14001 and ISO 50001 certified.

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Want to learn more?
bruker.com/microplastics